

Wageningen University – Department of social Sciences

Marketing and Consumer Behaviour Group

# **Consumers' acceptance of a nano-wrapped fresh-food product, a cross-cultural study**

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- MSC thesis -

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## **Abstract**

Nanotechnology represents a revolutionary technology that could bring changes in all spheres of human activity. The most expected nano-technology application that will enter the food market is a nano-package. The most important condition for market success of a new technology is acceptance of its applications by the general public. The innovation acceptance decision-making process is surrounded by great amount of uncertainty.

The main purpose of this study was to examine how lay people accept new technology and its application to food packaging. Another aim was to compare how the process of an innovation acceptance differed between Czech and Dutch societies.

Quantitative method of data collection, an electronically based questionnaire, was used to collect Czech (N=1213) and Dutch (N=62) responses. Obtained data were analyzed with the use of regression analyses, mediation analyses, independent samples t-tests and paired samples t-tests.

Results suggest that the society consumers live in influence individual uncertainty with an innovation. Moreover, it was shown that innovation acceptance is independent of the national cultural uncertainty dimension (CNUA). On the other hand the CNUA projects in perception of credence quality attributes (freshness, wholesomeness), as well as in the overall quality perception of an innovation.

The innovation acceptance seemed to be similar in both populations, i.e. consumers did not favour the nano-wrapped food product in either population; however the position of nano-package introduction would be better for Czech food market because the added benefit of freshness and overall quality perception is stronger for Czech than Dutch consumers.

## **Keywords**

Nanotechnology, nano-package, innovation acceptance, cross-cultural study, national cultural uncertainty dimension, uncertainty, freshness, mediation analysis, independent samples t-test, paired samples t-test

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## I. Introduction

Human beings as well as other living organisms have to eat to be able to survive. Nevertheless, an important difference between people and animals is that we position food above the act of necessary nutrition intake. Food is essential for every human culture in which is used to express various meanings and practices. (Frewer et al., 2011a) Today's humankind confronts serious problems with dynamically expanding population growth and consequent increase in food scarcity. This societal issue is not new but is repeatedly circulating through the whole human history. However, for the first time the human population will rise to more than 9 billion around 2050. (Brandon, 2011) Two hundred years ago Sir Thomas Malthus has introduced an idea that people at their best are able to increase food production arithmetically with the use of difficult production methods. On the other hand population is growing faster at geometrical rate. This logically results in food supply shortage, famine and spread of diverse population diseases. Malthus was the first social scientist who highlighted limitations of natural resources for further human material progress. (Seidl and Tisdell, 1999)

Food mainly comes from land. For its production we need fresh water, fertile soil, energy and active biodiversity. *'' Even if these resources are never depleted, on a per capita basis they will decline significantly because they must be divided among more people.''* (Pimentel et al., 1997) It is clear that with increasing population we need to find out new possibilities of how to feed more people within the range of limited natural resources and simultaneously create less environmental pollution. In the recent past science has showed its powers several times. For example, use of brand new chemical pesticides and high-yield varieties of grains was a corner stone of the success of green revolution. Science has helped to produce more food for the same price with the use of new technologies. (fao.org; Frewer et al., 2011a)

As people get richer they expect to get various food products, even if there are no favourable conditions for its production or processing at the local level. Thus, food chains are internationalizing all over the world. (Frewer et al., 2011a) This results in food transportation over long distances. Imperfect production, transportation and storage conditions increase the possibility of food spoilage during the way to the end-consumer. Thus, pointless food waste and additional environmental pollution are created. The only thing that protects the food product on the way to its consumer is a package. Food packaging is crucial for food preservation against oxidative and microbiological spoilage. Plastic packaging has been extensively used mainly because of its low production cost and adaptation to diverse needs of

food producers. Plastic package has low water evaporation transmission. It is made from petrol and it's non-degradable, and therefore increases environmental pollution. (Tharanathan, 2003)

It is evident that the agri-food sector needs new packaging technology to be able to supply fresh, safe and good quality food products to the end user and minimize useless food wastage. Scientists came up with new revolutionary technology which is called nano-technology. With the use of this technology scientists are able to enhance or change matter's properties such as strength, reactivity and electrical characteristics. (Siegrist et al., 2008; Royal Society and Royal Engineering, 2004) This technology is going to bring changes in all spheres of human activity. Currently, it is being introduced in pharmaceutical, medical, personal care products, Information and Communication technology, military and also in the food industry. (Gupta et al., 2011, Frewer et al., 2011a; Sozer and Kokini 2009)

Introduction of new food related technologies in agri-food area differ from other fields in one important aspect, i.e. food is close to everyone and additionally the innovated food products are ingested by the consumer. (Ronteltap et al., 2007; Rozin, 1999) That is why the food sector and its products are being subjected to higher public interest and attention. (Gupta et al., 2011; Frewer et al., 2011a) Another aspect that contributes to the slow process of nanotechnology implementation is the absence of unifying nanotechnology guidelines and regulations in agri-food industry. *'For this reason, most expected nano-application in the food market will probably occur in food packaging and only few in actual food products.'* (Sozer and Kokini, 2009)

Fundamental condition for new food-related technology market success is its acceptance by the general public. (Frewer et al., 2011b) Technology acceptance is based on consumers' acceptance of its application (or sometimes called innovations). (Ronteltap et al., 2007) In this case newly emerging technology is nanotechnology and its application that will enter the food market for the first time is nano-packaging. Acceptance of a new technology by both consumers and society is conditioned by risk perception - in terms of environmental pollution and human health impact. (Frewer et al., 2011a; Eiser et al., 2002)

Food industry invests considerable amount of money in nanotechnology research. Thus, the goal of investors is to produce innovations that will be successful on the food market. (Frewer et al., 2011b; Sozer and Kokini, 2009) They don't want to follow mistakes of poorly introduced technologies, e.g.: food irradiation and genetically modified food. These technological rejections were mainly caused by strong discrepancy between positive expert



and sceptic laic consumers' attitudes towards these technologies. (Frewer et al., 2011a; Ronteltap et al., 2007)

Consumers are demanding fresh and good quality food products to which they can trust. Nano-packaging could serve as an effective tool to satisfy above stated consumers' requirements. This technological innovation will enhance food safety, prolong shelf life of products and additionally may significantly contribute to the food waste reduction caused by food spoilage. (Kampers, 2011) This technology represents positive contributions for both - individuals and society. (Frewer et al., 2011b) On the other hand with every newly emerging technology come negative side effects of its application as well. Nano-technology is no exception. There is a possibility of negative health impact caused by nano-particles release from package surface directly into food which is consequently being consumed by the consumer. (Sozer and Kokini, 2009)

In summary, new food packaging is required to supply good quality products and minimize the food waste. New technology is an option to provide new food wrapping. Here, the new technology is a nano-technology which requires societal acceptance to be successfully introduced on the food market. To be able to fulfil the aim of this paper the research question how does public accept new technology and its application to food packaging needs to be answered.

## **II. Literature review**

### **What is nanotechnology and how does it apply into nano-package application**

Introduction of new technology in agri-food sector is always a complicated issue. Food is perceived to be closely connected with consumers because food products are being ingested. Therefore, every innovation in food sector will be subjected to higher attention and interest of the general public. (Frewer et al., 2011a; Ronteltap et al., 2007; Rozin, 1999)

#### **Nanotechnology**

Nanotechnology deals with matter production, manipulation and application of structures at the nanoscale level, usually in range of 100nm to an atomic level of 0.2 nm. To be able understand such a small physical dimension it is useful to draw a measure comparison. One nanometer (1nm) is one billion of a meter ( $10^{-9}$ ), in contrast a human hair is approximately 80,000 nm wide. Manipulation of matter at this size enables production of new or enhancing functions of existing materials. (Royal Society and Royal Engineering, 2004) The main reason for change in matters' behaviour is a high surface area to the volume ratio (Emamifar et al., 2010). An increase in the surface area results in considerably higher chemical, physical and electrical reactivity of a particular matter. (Royal Society and Royal Engineering, 2004)

Nanotechnology is not entirely unknown to nowadays science. The natural world is full of particles and processes functioning at the nanoscale. On the other hand scientists are able to create artificial nanoparticles and cause controlled processes with the use of high technology devices, such as atomic force microscope, for the first time. Every new technology brings lots of benefits as well as risks for its users. The negative side-effects of nanotechnology are most often related to the toxicity issue of freely moving nanoparticles that can cause harm to living organisms and environment. (Royal Society and Royal Engineering, 2004)

This technology has been already introduced in various spheres of human activity, e.g.: medicine, cosmetics, sports, military, manufacturing industry as well as in agri-food sector. (Gupta et al., 2011) Nanotechnology can be applied through the whole agri-food supply chain in various ways, from monitoring of plants' growth to creation of functional foods. (Cross et al., 2010) Due to the lack of unifying guidelines and regulations for food products the most expected innovation that will enter the food market is the nano-packaging. (Sozer and Kokiny, 2009) Therefore, this paper will focus on the use nano-packaging in the food sector.

## Nano-packaging

Most of today's food packaging is made of plastics. This packaging material replaced traditional wood, glass and metal packages. (Umberto et al., 2003) Use of plastics is a controversial issue. Firstly, for its production significant amount of scarce fossil fuels is used. Secondly, plastics are non-degradable materials that cause considerable waste problem and environmental pollution. (Sozer and Kokiny, 2009)

Currently, two types of nano-packages are recognized. The first type is "passive nano-packaging" which will have enhanced or new physical, mechanical and chemical functions, e.g.: better gas and moisture barriers, tensile strength, antibacterial and self-cleaning functions. The second type is called "active packaging" which will, for example: enable better monitoring and controlling of the food quality with the use of special nanosensors. These sensors will be able to react with pathogens included in the gas released from the food product inside the packaging. In case of contamination sensors will change their colour. Thus, easier control and better monitoring of product's safety and freshness through the whole food supply chain will be possible. Scientists also examine the use of nanotechnology for development of biodegradable packaging materials. (Cross et al., 2010; Sozer and Kokiny, 2009)

The ONVU time-temperature (T-T) labelling developed by Ciba and Freshpoint is an early example of an active-packaging. The ONVU is able to reflect on the chill-chain product's history from time of packaging till the end-user consumption, (see Figure 1). Thus, enable ensuring and direct recognition of the food product freshness. (onvu.com)

Both types of packaging serve as a helping tool for consumers, retailers and food industry in general. Enhanced package's properties such as: better gas and moisture barriers, use of nanosensors, antibacterial and self-cleaning functions will help to prevent food waste significantly. Moreover, improved tensile strength of the packaging would require less amount of material used for its production. Furthermore, development of biodegradable packaging would represent a promising solution for environmental pollution reduction.

Figure 1: ONVU T-T label



Source: Fresh Point,  
[http://www.freshpoint-tti.com/\\_userfiles/logos/OnVU.jpg](http://www.freshpoint-tti.com/_userfiles/logos/OnVU.jpg); available on

## **Public acceptance new technology and its application**

Technology acceptance is part of the technology assessment process which is aimed at reduction of costs and mistakes related to societal coping with new technologies. Importance of technology assessment was defined by both supranational, (e.g.: EU), and national authorities, (e.g.: Dutch Ministry of Economic Affairs), as a useful tool to minimize wrong investments, prevent social conflicts and direct R&D toward current social conditions to improve relationship with an end-user. The process is based on an ongoing interaction among technology, societal and meta-level actors who share common goals of reciprocal learning, anticipation and reflexivity. (Schot and Rip, 1996)

In the case of nanotechnology all interested stakeholders, (such as: governmental and semi-governmental bodies, firms, consumers' organizations and investors), are aware of the fact that social acceptance is critical for further successful technological development. (Scheufele and Lewenstein, 2005, Royal Society and Royal Engineering, 2004) They are willing to take part in societal debate. (Ronteltap et al., 2011) Therefore, nanotechnology represents quite a unique chance to take attitudes of public into account at an early stage of the technology development. Thus, nanotechnology, may avoid problems that, e.g.: technology of genetic modification was confronted with. (Siegrist et al., 2008; Siegrist et al., 2007) Moreover, technology acceptance is based on consumers' acceptance of its innovations. (Ronteltap et al., 2007)

Nanotechnology has a difficult starting position. It is considered to be a "natural inheritor" of negative consumers' experience with recent technological controversies (Kearnes and Wynne, 2007). These past experiences frequently refer to unsuccessful market introduction of genetically modified foods and irradiated foods. (Frewer et al., 2011a)

## **Consumer segments**

It is important to bear in mind that consumers who are the actual users of technological innovations are not a homogeneous group. Therefore, it would be wrong to presume that they hold the same opinion about given technology and its application.

The Theory of Diffusion of Innovations Rogers (1995) explains how an innovation is accepted or rejected in society over time. He divided consumers in five different groups normally distributed on the bell shaped curve. These groups are divided according to degree of innovativeness. Innovativeness is an extent to which an individual is able to adopt an innovation faster than other members of the society.

The first group of consumers are innovators. This group is relatively small and accounts for only 2.5 % of consumers in the society. Innovators possess special personality traits, such as: high tolerance for complexity and willingness to spend an effort on learning and coping with the new innovation. These people are usually more exposed to mass media and engage in sophisticated information search. Furthermore, innovators have high tolerance for novelty. (Vishwanath, 2003)

Another personality trait that could play an import role in this group is a predisposition to neophilia. Social scientists explain neophilia as an obsession for new things. This behavioural trait is alarming especially in Western societies. This trend can be demonstrated by consumers' hunger for new models of mobile phones. (Nagar, 2007) This kind of behaviour requires also sufficient financial sources since new innovations are usually more expensive than existing products produced in the large-scale production.

Innovators are followed by early adopters. They represent the second smallest group in the society (13.5%). These people share similar personality traits with innovators, such as reservedness towards high levels of ambiguity in decision making. (Vishwanath, 2003; Rogers, 1995)

On the other side of innovation acceptance spectrum are laggards who are the last group that accept the innovation in the society. This group stands for approximately 16% of consumers in the society. These people are sceptical toward new applications and their behaviour is considered to be neophobic, i.e. they are afraid of new things. This term is usually connected with food neophobia which results in a consumer's reluctance to consume new foods. (Raudenbush et al., 1998)

Between these two extremes another consumer group can be found, the so called early majority. This group accounts for more than one third of the overall consumption society (34%). According to Rogers (1995) consumers' segment between 10-20% of the population is a critical mass constituting hearth of the whole diffusion process which is a turn between early adopter and early majority. Therefore, early majority group creates an imaginary borderline that affect the pace and success of the innovation acceptance. Consumers who belong to this segment are not decided on their attitude towards new innovation contrary to innovators and laggards. Early majority group is followed by equally big group of consumers, so called late majority group.

It can be derived that the early majority consumers' group constitute an important part of the general public in the society. Therefore, it is necessary to pay attention to

characteristics of this consumer segment when introducing new technological application. Therefore, I will use the concept of early majority group to build up a conceptual model of the nanotechnology innovation acceptance.

### **Process of decision-making under uncertainty condition**

Steenkamp et al., 1999 defined three dimensions of national culture, such as: individualism, masculinity and uncertainty avoidance as important antecedents of consumer innovativeness. National cultural uncertainty avoidance is defined as: *“a degree to which societies tend to feel threatened by uncertain, risky, ambiguous, or undefined situations and the extent to which they try to avoid such situations by adopting strict codes of behaviour.”* (Steenkamp et al., 1999) Of all cultural dimensions, the uncertainty avoidance is the one which is closely related to the concept of new product adoption. (Lee et al., 2007) Thus, this dimension will be the most relevant for the purpose of the paper.

Societies with high uncertainty avoidance score tend to refuse innovations. Moreover, high national uncertainty avoidance will stimulate high degree of individual uncertainty avoidance behaviour, such as: avoidance of change from well established patterns and routine behaviour. Furthermore, society high in uncertainty avoidance will support institutions that tend to protect traditional and conservative ways of conduct. (Steenkamp et al., 1999) Therefore, it can be inferred that consumers in high uncertainty avoidance societies will not trust information sources promoting innovative behaviour. To make a comparison between countries of interest it is appealing to evaluate them on the national cultural uncertainty avoidance dimension. The Czech Republic scores relatively high on this dimension (74) in comparison to The Netherlands (53). (Didero et al., 2008)

In case consumers face new technology and its applications, where the provided information is incomplete, complex and ambiguous, uncertainty emerges. (Ronteltap et al., 2007) Nanotechnology is a clear example of a technology subjected to great uncertainty. Therefore, people do not base their decision-making under risk condition, where possible outcomes and probabilities of their happening are known. They perform the decision-making process under condition of uncertainty. In this situation probabilities are not sufficiently known. Moreover, lots of information about alternative options, consequences and trust in the information source are missing. (Hansson, 2004) The overall process of the acceptance or rejection of the technological innovation is based on uncertainty reduction. Consumers usually try to reduce the degree of uncertainty by seeking of information about particular innovation. (Vishwanath, 2003)

Several studies (Gupta et al., 2011; Frewer et al., 2011a; Siegrist et al., 2007; Scheufele and Lewenstein, 2005) have confirmed that the general public have poor knowledge about nanotechnology. Therefore, it is important to know how these people arrive at a decision about complicated issue, such as nanotechnology acceptance. First of all, the vast majority of people are not willing to invest much effort in profound cognition, i.e. they are able to base their decisions on limited and insufficient amount of knowledge. They rely on heuristics and cognitive shortcuts processes to arrive at judgements of a complex issue, e.g. nanotechnology innovation acceptance in food sector. (Scheufele and Lewenstein, 2005) People use heuristic, for example a trust, in case the provided information is incomplete. (Siegrist et al., 2008) *“Social trust refers to people’s willingness to rely on expert and institutions in the management of risks and technologies”*. (Frewer et al., 2003)

In consumer behaviour literature two different conceptual paradigms dealing with position of trust with regard to novel technology acceptance are distinguished. The first model was developed by Siegrist, (2007). He promotes that societal trust evokes affect in consumer which subsequently leads to risk-benefit perception from which a consumer derives final decision. This model is based on low knowledge audience principle and the fact that trust is based on shared values. Therefore, consumer has to rely just on these values. Research on the genetic modification (GM) technology revealed that people who trusted institutions related to GM regulation and promotion perceived more benefits and less risk. (Siegrist et al., 2007)

The other model designed by Eiser et al., (2002) underlines an importance of prior attitude that influence risk-benefit perception as well as trust. These factors together form new attitude towards novel technology. This model could be functioning well for a situation in which consumer already have some knowledge about new technology. Thus, he/she is able to form a prior attitude.

By comparing these pieces of knowledge it is obvious that the model of Siegrist et al., (2007) is closer to the idea of low knowledge general public than the model of Eiser et al., (2002). On the other hand findings of Hansson, (2004), that consumers perform decision-making process about novel future technology under great uncertainty, had lead to an idea that societal trust should rather be seen as a tool of an individual uncertainty reduction in the conceptual model.

Trust plays an important role in the innovation acceptance process. It is a tool used by consumers to reduce uncertainty. Moreover, it may also reduce perception of risk. (Ronteltap et al., 2007) At this point is important to make a clear distinction between uncertainty and risk

perception. An uncertainty is usually connected with something that is hard to predict. In case of new product an uncertainty is maintained by lack of structure and information. Thus, a consumer may expect almost anything as an outcome. On the other hand a risk is defined as specific result of a given situation. (Lee et al., 2007) Risk is perceived differently by both experts and laypeople. Experts understand risk based on technical assessment and probabilities of the technology malfunctioning. On the other hand the layperson includes much broader aspects in risk assessment, e.g. impact on future generations. It is clear that experts and laypeople differ in the risk definition. Laypeople usually miss certain information about technological hazard on the other hand their definition of risk is much more diverse, hence should not be omitted. (Slovic, 1987)

A study by Siegrist, (2000) also showed that acceptance of GM food was determined by perceived benefit. Therefore, consumers should be informed about nanotechnology products tangible benefits for the environment, society and particular individuals. Thus, they will perceive less risk and the willingness to buy the product will be higher. On the other hand perceived benefit will not solely lead to acceptance of technological application. (Siegrist et al., 2007)

The trade-off between risk and benefit perception about future novel technology should be seen as an intermediate outcome of the decision-making process under uncertainty condition. These than lead to acceptance or rejection of the novel technology application.



## Consumers' perception of a fresh food product

### Concept of freshness

The word freshness is frequently misused in the field of food science. (Bremmer, 2000) It is caused by varieties of context and ways the word is used by consumers, researchers and marketers. (Péneau et al., 2009) Consumers' understanding of the term freshness varies greatly between individuals and different types of food products. (Heenan et al., 2009)

First of all, it is necessary to define meaning of a fresh food product. From retailers and producers point of view the fresh food product usually belongs to one of following categories: bakery, dairy products; vegetables/ fruits; and meat (fish, poultry, beef and pork). (Nijssen and van Vliet, 1998) Freshness of these food products is perceived to be an important and decisive attribute necessary for the product choice and acceptance by consumer. Consumers most frequently relate the concept of freshness with vegetables and fruits (Péneau et al., 2009; Ragaert, et al. 2004). Additionally, it is a principal aspect affecting consumers' selection of baked products. (Heenan et al., 2009) In the area of meat production the term is crucial indicator of product safety. (Becker, 2000)

### Quality perception model

Consumers do the shopping and search for a product that satisfies their needs and wants. The product quality perception plays major role during consumers' purchase decision-making process. Freshness is closely related to the overall food product quality perception. (Péneau et al., 2009) The quality perception paradigm introduced by Steenkamp, (1989) explains how a consumer forms the overall quality perception about certain product. He divided the whole process in two main mutually interconnected sections. The first part of the model is called consumer's expectation and is constituted by quality cues related to the product. The second part is represented by an experience of the consumer with the product derived from products' attributes. It is important to make distinction between quality cues and quality attributes of the product, since they differ on the level of abstraction. *"Quality cues are concrete product characteristics that can be observed by a consumer, without actual consumption or usage, whereas quality attributes are abstract product benefits that can only be experienced as a consequence of consumption or usage of the product."* (Ophuis & van Trijp, 1995)


Consumers weigh quality of the food product based on quality cues. *"Quality cues are informational stimuli that are, according to consumer, related to the quality of the product, and can be ascertained by the consumer through senses prior consumption."* (Steenkamp,

1989) They are divided into extrinsic and intrinsic quality cues. Consumers will be affected only by cues that are able to scrutinize, thereby make an inference about expected quality attribute of the product. (Banovic et al., 2010) Intrinsic quality cues are said to be inherent to product itself, i.e. that they cannot be changed without changing the physical characteristics of the product, (see Table 1). These cues can differ according to specific food category. (Ophuis and van Trijp, 1995) Extrinsic cues are related to the product but not solely with the physical part of the product, (see Table 1). These cues can be changed without changing the product itself. However, as Ophuis and Van Trijp, (1995) discussed the process of changing extrinsic cues is sometimes more difficult than altering the intrinsic cues of the product.

Consumers use quality cues to be able to determine attributes they desire in a product. (Northen, 2000) ‘*Quality attributes are functional, psychological benefits provided by product.*’ (Steenkamp, 1989) The consumer-behaviour literature distinguishes between two types of quality attributes. The first type is an experience quality attribute which can be ascertained on the basis of actual experience of the consumer with the product, e.g. by usage or consumption. (Steenkamp, 1989) At this stage intrinsic or so called sensory quality cues are more salient. Experience quality attributes may be used to predict credence quality of the product. (Becker, 2000)

The second type is credence attribute. Consumers are not able to experience this quality attribute directly during or immediately after the product consumption. They have to rely on information provided by a third party, e.g. producers, retailers, experts, regulating authorities, controlling bodies and media. Therefore, the credence quality attribute formation requires more time than experience quality attribute. (Steenkamp, 1989) Extrinsic quality cues are dominant helping tools from which consumer determine credence quality attributes. Credence attributes are usually used to judge the product quality with regard to health, safety and other consumers’ concerns. (Becker, 2000) Food related technologies are often associated with credence qualities, e.g.: safety, naturalness and health. These qualities easily cause feelings of uncertainty and risk in consumers because they are not able to experience them personally. (Ronteltap et al., 2007) The overall product quality judgement then consumer bases upon beliefs derived from experience and credence quality attributes. (Steenkamp, 1990)

**Table 1:** The position of the concept of freshness in the Quality Perception Process (QPP), (based on articles of: Fenko et al., 2009; Péneau et al., 2009; Ronteltap et al., 2007; Becker, 2000; Steenkamp, 1990)

Components of QPP	Intrinsic	Extrinsic
<b>Product Quality Cues</b> (available in the shop before purchase)	Colour, smell, texture, structure	Brand, label, packaging, place of purchase, price, country of origin, nutritional information, size, weight, shelf life of the product
<b>Experience Attributes</b> (experience of the consumer with the product during its usage or consumption)	Smell, tenderness, flavour, juiciness, colour, texture, structure	
<b>Credence Attributes</b> (after consumption experience, consumer's concerns)	 <p><b>Freshness</b></p>	Country of origin, treatment of the product during the whole production process, nutritional information, safety and health concerns

\*Arrows represent a great mix of extrinsic and intrinsic cues and attributes that may influence consumers' perception of the concept of freshness.

### Concept of freshness in Quality Perception Process

Freshness, as illustrated in Table 1, is a multidimensional sensory and non-sensory experience of the consumer with the product. (Fenko et al., 2009; Péneau et al., 2009) Therefore, freshness is seen as a specific quality concept because it is comprised of a great mix of various extrinsic and intrinsic quality cues, e.g.: shelf life, diverse sensory characteristics, product's treatment during the whole production process, nutritional value, safety aspects. (Péneau et al., 2009) Freshness is perceived to be a strong intrinsic credence quality attribute used by consumer to judge credence quality of a product. (Becker, 2000)

### Product quality perception and uncertainty

A study of Lee et al., (2007) has shown that the uncertainty avoidance dimension of national culture affects consumers' quality judgements and purchase intention. Their study revealed that consumers from high uncertainty avoidance societies perceive product related with high uncertainty of low quality. Moreover, these consumers have lower purchase intentions to buy a high uncertainty product. Thus, consumers from high uncertainty countries tend to rely more on their quality judgements during the decision-making process, contrary to consumers from low uncertainty avoidance countries.

### **Consumers' discrepancies**

Use of novel nano-packaging technology will enhance some of the product quality cues considerably. For example: extension of the product shelf life, better preserved nutritional value and longer-lasting sensory characteristics.

On the other hand consumers perceive a food product to be fresh if it is: unpackaged, unprocessed, limited by short shelf life and usually requires to be refrigerated. (Nijssen and van Vliet, 1998) Moreover, the degree of food product freshness consumers base on the level of the product closeness to the origin, i.e. sensory characteristics of the product, distance of the product from its place of origin to the shop, time passed from harvest and techniques of food processing used. (Péneau et al., 2009; Cardello, 2003)

In case the fresh food product will be packed with the use high-technology nano-packaging several major discrepancies between consumers' fresh food perception and this new food preservation technology may occur. Firstly, important aspect stated by consumers was that fresh food product is unpacked. Therefore, use of nano-packaging may strongly contradict with consumers' vision of fresh food product because consumers associate packaging with processed food products. (Nijssen and van Vliet, 1998)

Another important characteristics mentioned by consumers about fresh food product perception are the function of time passed from product's harvest and the distance from product's place of origin to its place of purchase. Use of nano-packaging will considerably prolong shelf-life of a fresh food product and thus the long-haul transportation with lower amount of spoiled food products will be possible. On the other hand consumers may have doubts about truthfulness of prolonged date of expiration since they are used to time-bounded fresh food product quality evaluation.

A further important facets of the fresh food product are its sensory characteristics and no or very soft method of the fresh food product processing. Nano-packaging will enable to keep the fresh food product's sensory characteristics relatively unchanged. Consumer may perceive nano-packaging as an additional artificial treatment that may change the fresh food product naturalness and thus the product may no longer be perceived as fresh, hence not attractive for consumer to buy.

These discrepancies may result in consumers' refusal of the novel food technology application which could lead to the rejection of the nano-technology in a broad sense.

## Main concepts summary and hypotheses development

Market success of new technology is dependent on acceptance of its applications by the general public. (Vishnawath, 2003) The majority of consumers usually lack sufficient amount of knowledge and information to be able to make a decision about such complicated issue. (Gupta et al., 2011; Frewer et al., 2011a; Siegrist et al., 2007; Scheufele and Lewenstein, 2005) Thus, a significant level of uncertainty emerges.

Uncertainty avoidance behaviour of an individual is however influenced by more abstract cultural national uncertainty avoidance (CNUA) dimension of the society the consumer lives in. (Steenkamp et al., 1999) When comparing countries of interest on this dimension, (The Czech Republic scored (74) and The Netherlands (53)), it can be hypothesized that:

**Hypothesis 1:** *A consumer who lives in society with higher CNUA score will tend to be more uncertain with the novel innovation in contrary to consumers from countries with lower CNUA score.*

According to Steenkamp, (1989) the process of overall quality formation is divided in two main sub-phases. Firstly, the consumer sense the quality cues related with the product, (e.g. product's package). Secondly, based on these quality cues are being derived more abstract quality attributes, (e.g. colour experience and notions of freshness or wholesomeness), that are expected or desired by consumer in the product. The overall product quality is then based upon consumer's believes derived from product's quality attributes. (Steenkamp et al., 1999) Because the food product quality is an important purchase precondition it is hypothesized that:

**Hypothesis 2:** *An experience quality attribute positively associated with a credence quality attribute, has a positive effect on the credence quality attribute perception.*

Since the credence quality attributes have to be trusted, i.e. are hardly to be experienced directly by a consumer, an uncertainty emerges. (Rontletap et al., 2007) The uncertainty of an individual consumer with the new innovation is influenced by more abstract cultural national uncertainty avoidance dimension. (Steenkamp et al, 1999) Thus, consumers who live in a society with a higher CNUA score (CZ=74) would perceive the credence quality attribute (freshness, wholesomeness) related to an innovation of lower level than consumers from society with lower CNUA score (NL=53).

**Hypothesis 3:** *Consumers from country with high CNUA score would perceive the credence quality attribute related with an innovation of lower level than consumers from country with lower CNUA score.*

Credence and experience quality attributes together form an overall quality perception of the food product. (Steenkamp et al., 1999) It can be inferred that:

**Hypothesis 4:** *If an experience quality attribute is positively associated with credence quality attribute, they both have a positive effect on the quality perception.*

Consumers from societies with high CNUA score judge product related with high uncertainty, (e.g. a novel innovation), as low quality product. (Lee et al., 2007) Thus, it can be derived that low quality perception increases consumer's uncertainty with an innovation. A hypothesis follows:

**Hypothesis 5:** *High quality perception lowers individual consumers uncertainty related with an innovation.*

The whole process of acceptance of novel technological application is based on uncertainty reduction. (Vishnawath, 2003) It was shown that the majority of consumers are not willing to spend much effort to search information about complicated issues. These consumers rely on heuristics, such as social trust, that help them to reduce uncertainty they hold towards a novel innovation. (Scheufele and Lewensteins, 1995; Rontletap et al., 2007) Therefore, an increase of consumer's trust in the social trust actor will be accompanied by decrease of consumer's individual uncertainty with an innovation. Following hypothesis is proposed:

**Hypothesis no. 6:** *An increase of consumer's uncertainty with an innovation leads to decrease of individual consumer's trust in the social actor.*

Social trust plays an important role in the innovation acceptance process because it reduces an uncertainty that surrounds this process as well as risk perception that consumer experience with new innovation. The following hypotheses are derived:

**Hypothesis no. 7a:** *An increase in social trust leads to decrease in risk perception.*

**Hypothesis no. 7b:** *An increase in social trust leads to increase in benefit perception.*

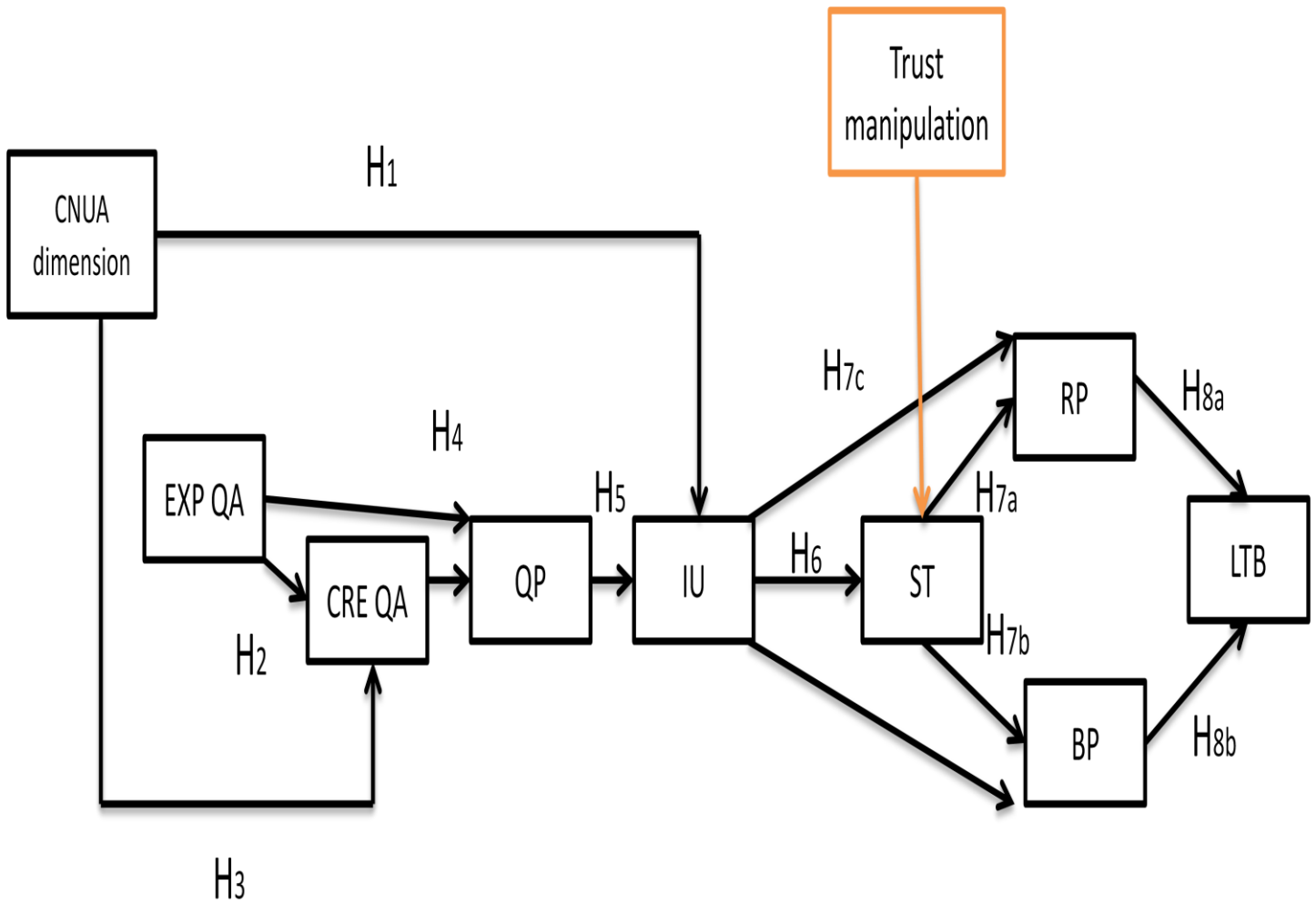
**Hypothesis no. 7c:** *The effect of uncertainty on risk-benefit perception is fully mediated by social trust.*

In case a consumer perceives higher risk than benefit with regard an innovation, following hypotheses are relevant:

**Hypothesis no. 8a:** *Higher risk perception reduces innovation acceptance.*

**Hypothesis no. 8b:** *Higher benefit perception increases innovation acceptance.*

### III. Theoretical model



**Note:** For explanation of all abbreviation used in this theoretical model, see page 29.



## IV. Methodology

Following study addresses two main issues. The first issue of concern deals with consumers' acceptance of novel technology innovation in the food sector, where the product of interest is represented by a commonly known vegetable (a cucumber) wrapped with the use of new nano-packaging material. The second issue relates to comparison of two different consumer populations on their attitudes towards this innovation.

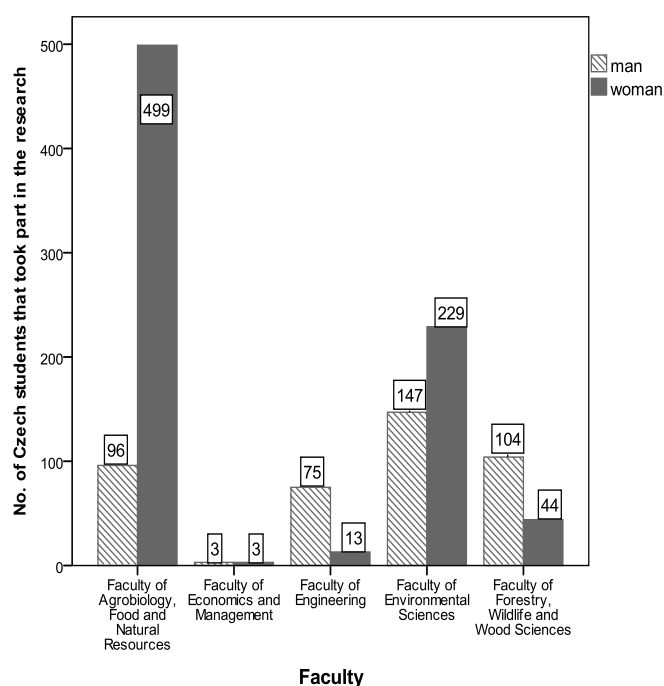
### Studied populations

Participants were recruited from students of two European life science universities: The Czech University of Life Sciences in Prague (CZ) and the Wageningen University (NL) via electronically based questionnaire.

### Czech participants

The total number of responses obtained from Czech participants was 1,852; from which 1,213 responses were valid. The 619 responses were removed because they did not contained information necessary for further data analyses. The amount of contacted people was around 10, 000; therefore the return rate of valid responses is 12.13%. From 1,213 of valid responses

**Figure 2: Bar chart;** No. of Czech students that took part in the research distributed according to their study specialization



35% were men (N=425) and 65% were women (N=788).

Data were collected from 22<sup>nd</sup> February till 23<sup>rd</sup> March 2012. The mean age of Czech participants was 22.13 years. The Figure 2 represents demographic information about study specialization of Czech participants that took part in the research

It is obvious that the majority of responses came from Faculty of Agrobiolgy, Food and Natural resources.

The least amount of responses came out of Faculty of Economics and Management. The Dean

of this faculty did not provide a permission to contact their students via their school email address.

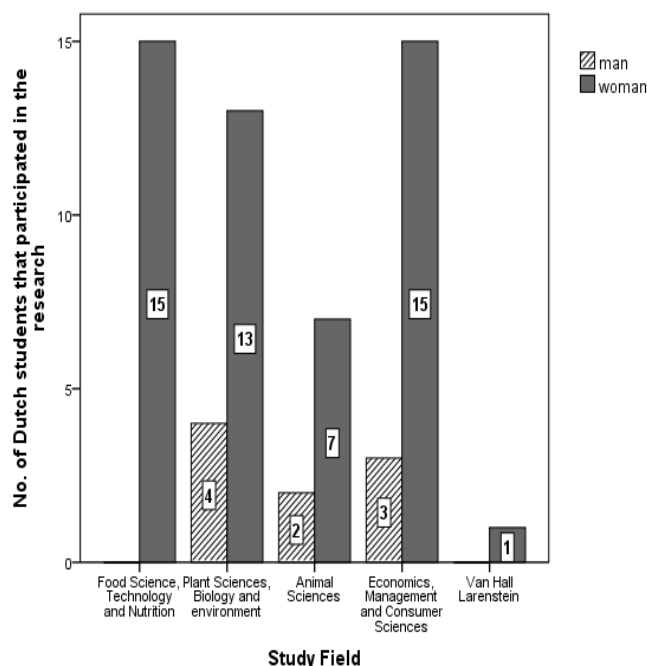
### Dutch participants

Total amount of Dutch responses was 77, from which 15 were considered to be invalid.

Although, another 11 participants did leave some questions without the answer, they were left

in because the basic information

**Figure 3: Bar chart;** No. of Dutch students that took part in the research distributed according to their study field



\*2 respondents did not provide information about their study field

needed for further data analyses was covered. From 62 valid responses were 14.5% men (N=9) and 85.5% (N=53) were women. The total number of contacted students was 800; therefore the return rate of valid responses is 7.8%. Data were collected between 9<sup>th</sup> March and 9<sup>th</sup> April 2012. The mean age of Dutch participants was 21.29 years. The most valid responses came from students that were specialized in Economics, Management and

Consumer studies followed by students interested in Plant Sciences, Biology and Environment, (see Figure 3).

### Sampling

Both Czech and Dutch respondents were contacted via their school email address. The message contained a short text with a link reference directing to the questionnaire. The text informed participant that the study is about usage of the new technology – a nanotechnology in food sector. Czech respondents were recruited from students of the Czech University of Life Sciences in Prague, namely from faculties of: Agrobiology, Food and Natural Resources; Economics and Management; Engineering; Environmental Sciences; and Forestry, Wildlife and Wood Sciences. Dutch respondents were recruited from students of Wageningen University. Recruiters decided spontaneously whether they want to take part in the study and fill in the questionnaire or not.

### **Object of the study**

A cucumber was selected as a representative of a fresh food product for two main reasons. First of all, a cucumber is a vegetable available almost in any European supermarket during any year's season. Therefore, it is a well known food product to the majority of consumers. Moreover, as was mentioned in the literature overview consumers relate a concept of freshness most frequently with vegetables (Péneau et al., 2009; Ragaert, et al. 2004). Second aspect that determined the choice of the object is the fact that cucumber is currently being packed in plastic. Thus, consumers will not perceive nano-wrapped cucumber as completely different product. It can be derived that cucumber as a fresh food product could serve well for the purpose of the study. Thus, the nano-packed cucumber represents an experimental product and conventionally wrapped cucumber plastic is a control product.

### **Design of nano-wrapping**

A nano-wrapping is still not introduced on the food market. Thus, it was necessary to create a new visage of the nano-wrapping. For this purpose a picture showing group of three cucumbers packed in plastic was used as a starting point. The clear plastic material serves with two important functions. Firstly, it is clear, thus consumers are able to scrutinize visual characteristics of the product. This aspect is crucial for the electronically based questionnaire. Secondly, it serves as a barrier between the product and the environment. Therefore, consumers perceive that there is "something" on the surface of the product.

The other important step was to create difference between conventional (plastic) wrapping and new form of a nano-package. The new nano-wrapping was designed as a clear matter similar to plastic material. The main difference between new and old form of packaging was a tiny yellow stripe around the nano-packed cucumber carrying a logo of the new technology - **NANO**, see Figure 4 and Figure 5. The yellow stripe could serve as a distinguishing and informative element carrying logo, bar code and other product and process information. The yellow stripe clearly signalize to consumer that the cucumber was packed with the use of novel technology.

It was necessary to create clear visual difference between a nano-wrapped cucumber and the cucumber packed with the use of conventional plastic material. However, the difference should be moderate. Thus, the consumer would be able to categorise the new product's package within the frame of his/ her current set of knowledge. In case the difference between new and old form of packaging would be too big, this fact could negatively influence consumers' evaluation of the new form of packaging. (Schoormans and Robben, 1997)

**Figure 5:** Nano-wrapped cucumbers



**Figure 4:** Conventionally-wrapped cucumbers



### **Pilot test**

A pilot test was conducted to minimize possible inaccuracies in the final version of the research questionnaire. Ten respondents were asked to participate in this survey. Their tasks were to fill in a questionnaire created for the purpose of the study and assess its quality on following criteria: difficulty of the questions, wording of the survey, do predefined answer choices correspond with related question, length of the survey and time needed to fill in the questionnaire. Respondents also had a chance to give their suggestions for survey improvement, to guess what the objective of this study is and express their personal believe about the nano-wrapping existence.

Results from this pilot test showed that the majority of respondents had no problem to understand the survey wording, questions were not difficult to answer and the predefined answer choices were matching with particular question. About 80% of respondents judged the length of the survey as just about right. The time needed to fill in the survey was estimated to 8 minutes on average.

### **Outcomes of open-ended questions:**

Respondents estimated that the aim of the study is to gather information whether consumers would be willing to buy a product packed with the use of this new packaging technology or to what extent consumers trust new food related technology. Their guesses were very close to the research objective.

Participants' suggestions for the survey improvement highlighted two important issues that needed closer inspection. The 60% of respondents were missing a "neutral" or an "I don't know" answer choice. Initially, predefined answer choices were designed on four point

Likert scale to compel respondent to express his/ her opinion and thus to avoid consumers' tendency to score central. The answer choices were scaled up to 5 points because the study is about a new package technology that is still not introduced on the food market, thus not all respondents would be able to express their opinion directly. The second relevant suggestion given by pilot test participants was related with a manipulation of trust variable. Firstly, each questionnaire disposed with two different versions of story that was carrying contradictory information released by social trust actor for studied and control product. This has lead to confusion of 50% of all participants. Based on this remark necessary changes were done. Thus, each version of the questionnaire contained only one story specifically designed for the purpose of the variable manipulation.

The pilot test questionnaire was concluded by a question whether consumers believe that the nano-package exists. Results showed that 50%, (from which 30% scored as: *yes, it exists* and 20% *it may exist*), of respondents believe that the nano-package exist and the other half of respondents do not, (respectively: 20% rather no and 30% not it does not exist). This information was an important proof that the studied product is not perceived as being completely unrealistic by potential consumer.

### **Data collection method**

#### **Questionnaire**

The survey starts with an introduction text in which the general information about nano-technology and its application (a nano-wrapping) are given. The content of the text has been based on the assumption that majority of consumers have low knowledge about nano-technology in general. Therefore, the text was designed to present balanced information about possible benefits and risks of the nano-wrapping usage in the food sector.

Questions were divided in two main blocks. The first block of questions was dedicated to the experimental product, i.e. the nano-wrapped cucumbers. It contained 9 questions. The second block concerns the control product, a fresh food product (cucumbers) wrapped with the use of conventional plastic material. It contains same set of questions as in the experimental block. Both blocks start with a short introduction and presented picture of nano or conventionally wrapped cucumbers. The questionnaire was designed in Qualtrics. This programme enabled to randomize flow of question blocks in both versions of the questionnaire. Each questionnaire also contained third block of additional questions composed of 4 demographic, 4 control and 1 questions dedicated to social trust variable

manipulation. In total, each version of the questionnaire had 27 close-ended questions. All questions used in the questionnaire were based on various studies, (see APPENDIX 1).

### **Procedure and measurement**

The questionnaire was developed in three steps. First, it was developed in English and then back-translated to Czech language. Then it was administered to 10 Czech people (pilot study). After changes were made it was also translated into Dutch. The questionnaire was translated into national languages, i.e. Dutch and Czech, to facilitate and speed up reading of the text which is necessary for e-based survey.

The questionnaire was created to measure 9 variables:

1. EXP QA = Experience quality attribute was measured by level of respondent's attraction with the product's colour (visual experience of the potential consumer).
2. CRE QA= Credence quality attributes were measured by perceived level of freshness and wholesomeness.
3. QP= Quality perception was measured by participant's overall quality perception of given product.
4. IU= Individual uncertainty was measured by level of individual confidence with the product.
5. ST= Social Trust was measured by level of trust that the respondent invested in retailer's purchase advice who was considered to be an actor of social trust.
6. RP, BP= Risk and benefit perception were measured by level of perceived risk and benefit towards particular product by respondent.
7. LTB= Product acceptance was measure by likelihood of a participant to buy certain product.

**Trust manipulation-** the social trust variable was manipulated by a story-telling where the actor of social trust (a retailer) favoured nano or conventionally wrapped product.

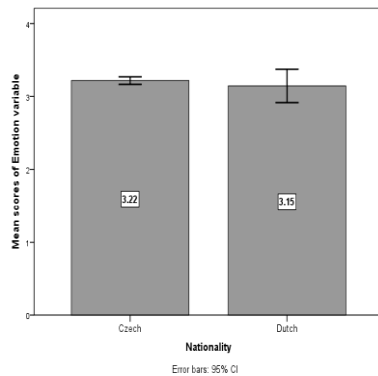
## V. Results

### General variables

#### Emotions

The process of new technology innovation acceptance is not purely based on strict cognitive process where consumer weights pros and cons related with an innovation. Therefore,

**Figure 6:** Bar chart; Emotions of Dutch and Czech respondents with regard to a nano and conventionally wrapped products



emotions may play important role in the whole acceptance process.

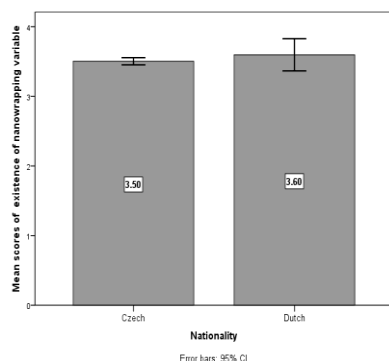
The Czech and Dutch populations were compared on the nature of emotions they felt towards a presented innovation, (a nano-wrapped fresh food product). The outcome of independent samples t-test with no equal variances assumed has revealed that Czech and Dutch populations did not significantly differ on the nature of emotions the felt towards an innovation, where  $M_{Czech}(3.22)$ ,

$SD=.922$ ,  $M_{Dutch}(3.15)$ ,  $SD=.903$  and  $t(67.670)$ ,  $p=.535$ .

#### Existence of the nano-wrapping

Since the nano-wrapping application has not been introduced on the food market yet, it was

**Figure 7:** Bar chart; Opinions of Czech and Dutch respondents about nano-wrapping existence



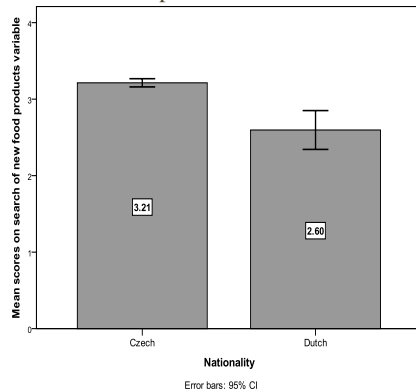
interesting to compare both populations on their opinion about a nano-wrapping innovation existence. The results of

independent samples t-test with no equal variance assumed demonstrated that: Czech and Dutch populations did not significantly differ on this dimension,  $M_{Czech}(3.50)$ ,  $SD=.903$ ,  $M_{Dutch}(3.60)$ ,  $SD=.914$  and  $t(67.241)=-.783$ ,  $p=.437$ . Based on both sample mean values can be inferred that both Czech and Dutch participants think that the nano-wrapping innovation probably exists.

## Search for new food products

The process of innovation acceptance may be influenced by the degree to which potential

**Figure 8: Bar chart;** Frequency of searching for new food products of Czech and Dutch respondents

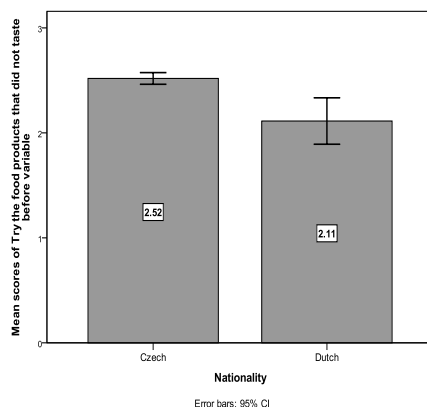


consumers tend to search for new food products, i.e. to what extent they are neophilic. The results of independent samples t-test with no equal variances assumed are following:  $M_{\text{Czech}}(3.21)$ ,  $SD=.956$ ,  $M_{\text{Dutch}}(2.60)$ ,  $SD=.999$  and  $t(66.833)=4.750$ ,  $p<.001$ . Thus, it can be inferred that Czech and Dutch respondents significantly differ to what extent they tend to search for new food product. Based on the sample mean values could be said that Czech participant are more neophilic than Dutch respondents.

## Willingness to try a product never tasted before

Consumers may also differ on the degree to which they tend to experiment and taste new food

**Figure 9: Bar chart;** the tendency of Czech and Dutch consumers to try new food product that did not taste before



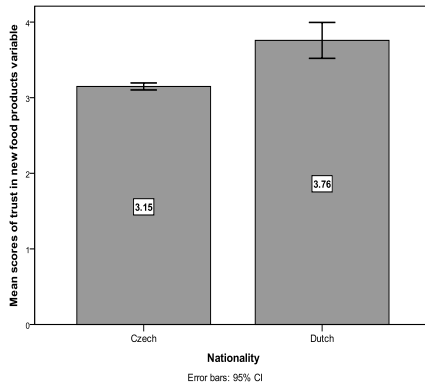
products they have never tasted before. The findings of independent samples t-test with no equal variances assumed confirmed that Czech and Dutch populations significantly differ on this dimension:  $M_{\text{Czech}}(2.52)$ ,  $SD=.986$ ,  $M_{\text{Dutch}}(2.11)$ ,  $SD=.870$  and  $t(69.254)=3.555$ ,  $p=0.001$ . Therefore, it is possible to say that Czech participants tend to be more experimental in relation to a food product that was not tasted before than Dutch respondents.



## Trust in the new food products

Retailers present new food products in their shops very often. Therefore, it is interesting to

**Figure 10: Bar chart;** Extent to which compare which population tend to trust to new food Czech and Dutch consumers trust in new food products



products more. The outcomes of independent samples t-test with no equal variances assumed revealed that Czech and Dutch respondents significantly differed on the level of trust in new food products,  $M_{\text{Czech}}(3.15)$ ,  $SD=.823$ ,  $M_{\text{Dutch}}(3.76)$ ,  $SD=.935$  and  $t(65.920)=-5.034$ ,  $p<.001$ . Thus, it can be derived that Czech participants trust in new food products less than Dutch respondents.

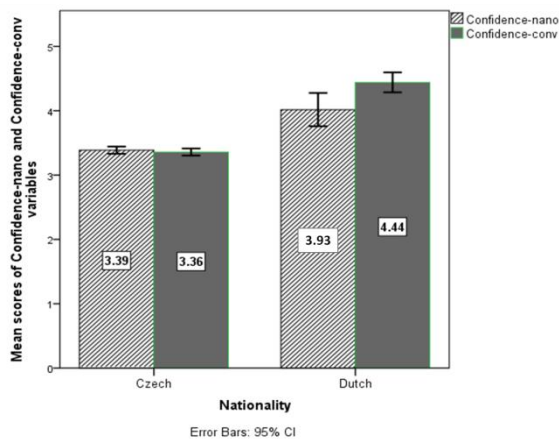
The outcomes of independent samples t-tests with no equal variance assumed has revealed that the difference between studied populations is not in the feelings and believing about in the presence of the innovation but rather in the way of reasoning. Moreover, it seems that Czech participants tend to be more experimental with regards new food products. On the other hand Dutch participants trust more in new the food products. In the next section the innovation acceptance process will be examined.

## Main research variables

### Individual level of uncertainty

To test Hypothesis 1 it was necessary to compare Czech and Dutch populations on the level of perceived individual uncertainty with an innovation, (measured by an individual confidence with a particular product). Following results were derived from the independent samples t-test with no equal variances assumed. For conventionally wrapped product the t-test outcome  $t(73.697) = -13.162$ ,  $p < .001$  has revealed that there was a significant difference between  $M_{\text{Czech}}(3.36)$ ,  $SD=.964$  and  $M_{\text{Dutch}}(4.44)$ ,  $SD=.595$ . Furthermore, for a nano-wrapped product the  $t(65.307) = -3.879$ ,  $p < .001$ ,  $M_{\text{Czech}}(3.39)$ ,  $SD=1.001$  and  $M_{\text{Dutch}}(3.93)$ ,  $SD=1.078$  also confirmed a significant difference between group means. Based on outcomes of independent

**Figure 11: Bar chart;** Confidence with conventionally and nano wrapped products of Czech and Dutch participants



samples t-test can be inferred that Czech participants who come from society with higher national uncertainty avoidance score (CNUA=74) perceive lower confidence with a nano-wrapped product, i.e. a higher uncertainty, than Dutch participants who belongs to society with lower CNUA score (53), (see Figure 11). Thus, Hypothesis 1 could be accepted.

Figure 11 graphically demonstrates mean scores on confidence variable for both populations. With the use of paired samples t-test can be said that Czech participant do not perceive a significant difference in confidence between nano and conventionally wrapped fresh food products; where  $t(1212) = .901$ ,  $M_{\text{nano}} = (3.39)$ ,  $SD=1.001$ ,  $M_{\text{conv}} = (3.36)$ ,  $SD=.964$ ,  $p=.368$ . On the other hand Dutch respondents differ significantly in the level of perceived confidence between products of interest. The outcomes of paired samples t-test were following:  $t(58) = -3.491$ ,  $M_{\text{nano}} = (3.93)$ ,  $SD=.991$ ,  $M_{\text{conv}} = (4.44)$ ,  $SD=.595$ ,  $p < .05$ . It can be summarized that Dutch participants perceived significantly higher confidence with conventionally wrapped fresh food product than the nano-packed alternative. Due to different group sizes it was not possible to test interaction effects between variables.

### Colour experience

Hypothesis 2 deals with relationship between visual colour experience derived from a presented picture of nano or conventionally wrapped product and the consequent perception

of product's freshness and wholesomeness. Outcomes of simple linear regression analysis showed consequent results for Czech and Dutch respondents, (see Table 2).

**Table 2:** Summary of outcomes of simple linear regression analysis of colour on credence attributes

Participants	B <sub>nano</sub> coefficient (colour)	r <sup>2</sup>	Sig.	95% CI for B's		B <sub>conv</sub> coefficient (colour)	r <sup>2</sup>	Sig.	95% CI for B's	
Czech	Nano-wrapped					Conventionally-wrapped				
freshness	.608	.366	<.001	.563	.653	.580	.312	<.001	.531	.628
wholesomeness	.432	.176	<.001	.379	.485	.407	.163	<.001	.355	.459
Dutch	Nano-wrapped					Conventionally-wrapped				
freshness	.527	.227	<.05	.264	.789	.335	.136	<.05	.115	.555
wholesomeness	.392	.166	<.05	.161	.623	.343	.165	<.05	.142	.544

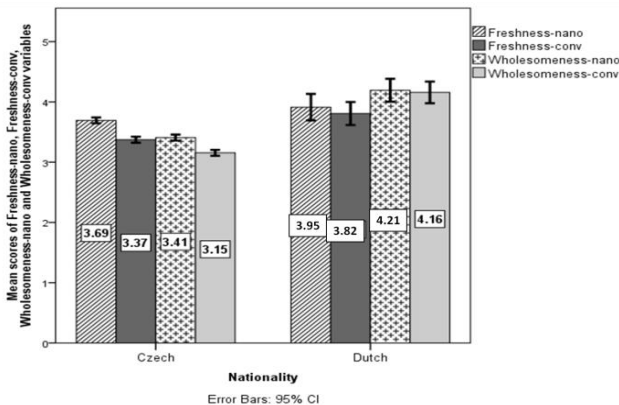
The regression weights presented in Table 2 demonstrates that there are significantly positive relationships between the visual experience of the product's green colour (experience quality attribute) and perceived freshness or wholesomeness (credence quality attribute). The results are same for both studied populations. Thus, Hypothesis 2 could be accepted.

Moreover, it can be inferred that no matter in what wrapping (nano or conventional) the fresh food product is packed, the green colour always evokes freshness and wholesomeness for both Czech and Dutch consumers.

### Freshness, wholesomeness

To be able to test Hypothesis 3, where the perceived level of credence quality attributes

**Figure 12: Bar chart;** Perception of freshness and wholesomeness of nano and conventionally packed products by Czech and Dutch participants



(freshness or wholesomeness) is expected

to be lower for Czech than Dutch population, an independent t-test analysis with no equal variances assumed had to be conducted.

The outcomes of independent samples t-test analysis with no equal variances assumed showed that Czech and Dutch populations significantly differed in

freshness perception of both conventionally ( $M_{\text{Czech}}(3.37)$ ,  $SD=.897$ ,  $M_{\text{Dutch}}(3.82)$ ,  $SD=.719$ ;  $t(69.743) = -4.677$ ,  $p < .001$ ) and nano-wrapped product ( $M_{\text{Czech}}(3.69)$ ,  $SD=.860$ ,  $M_{\text{Dutch}}(3.95)$ ,  $SD=.839$  and  $t(64.065) = -2.284$ ,  $p < .05$ ). Moreover, the paired samples t-test revealed that

Czech respondents differ significantly in perception of freshness between conventionally and nano-wrapped products, where  $M_{\text{nano}}(3.69)$ ,  $SD=.860$ ,  $M_{\text{conv}}(3.37)$ ,  $SD=.897$ ,  $t(1212)=12.162$ ,  $p<.001$ . On the other hand Dutch participants do not significantly differ on this dimension;  $M_{\text{nano}}(3.95)$ ,  $SD=.835$ ,  $M_{\text{conv}}(3.82)$ ,  $SD=.729$ ,  $t(57)=1.097$ ,  $p=.227$ . Based on these findings could be said that Czech participants perceived a food product to be more fresh when is wrapped in nano material. In case of Dutch respondents the difference is not significant, (see Figure 12). When comparing both populations on this dimension, the Czech evaluated the level of freshness of nano and conventionally-wrapped product lower in comparison to Dutch participants, as illustrated in Figure 12.

In case of wholesomeness perception the statistically robust difference between Czech and Dutch consumers has been proved for both nano ( $M_{\text{Czech}}(3.41)$ ,  $SD=.882$ ,  $M_{\text{Dutch}}(4.21)$ ,  $SD=.727$ ;  $t(70.495)= -8.369$ ,  $p< .001$ ) and conventionally ( $M_{\text{Czech}}(3.15)$ ,  $SD=.870$ ,  $M_{\text{Dutch}}(4.16)$ ,  $SD=.663$ ;  $t(70.814)= -11.405$ ,  $p< .001$ ) wrapped products. Furthermore, the paired samples t-test demonstrated that Czech respondents significantly differ on level of perceived wholesomeness between nano and conventionally wrapped products, where ( $M_{\text{nano}}(3.41)$ ,  $SD=.882$ ,  $M_{\text{conv}}(3.15)$ ,  $SD=.870$ ;  $t(1212)= 10.099$ ,  $p< .001$ ) in comparison to Dutch participants ( $M_{\text{nano}}(4.21)$ ,  $SD=.726$ ,  $M_{\text{conv}}(4.16)$ ,  $SD=.663$ ;  $t(60)= .341$ ,  $p=.735$ ). Thus, it can be said that Czech respondents evaluated the level of wholesomeness of nano and conventionally wrapped products lower than Dutch participants. Moreover, Czech respondents perceived the nano-wrapped product to be more wholesome in comparison to the conventional alternative. Dutch participants do not significantly differ on this dimension, (see Figure 12).

Since, Hypothesis 3 expected that consumers from society with higher CNUA score (CZ=74) will perceive lower level of credence quality attribute, (freshness, wholesomeness), in comparison to consumers from society with lower CNUA score, (NL=53). Hypothesis 3 could be accepted.

### **Quality perception**

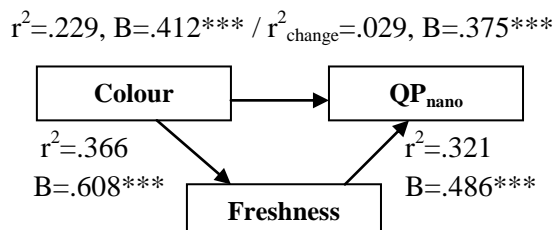
In order to test Hypothesis 4, that deals with effect of both experience and credence quality attributes on the overall product's quality perception, it was necessary to engage in the mediation analysis. The mediation analysis explains a causal chain in which experience quality attribute (colour attractiveness) affects credence quality attribute (freshness or wholesomeness) that, in turn, affects the overall products quality perception.

The mediation analysis was based on Baron and Kenny, (1986) and consists of following steps. Firstly, it was necessary to conduct a simple regression analysis between colour attractiveness and quality perception of a particular product, (first direct effect). Second step covered simple regression between colour attractiveness and freshness or wholesomeness. The third step included testing of two regression models. The first model was created with the use of simple regression analysis where freshness or wholesomeness predicts the product quality, (second direct effect). The second model deals with multiple regression, where colour attractiveness and freshness or wholesomeness are predictors of quality perception, (indirect effect).

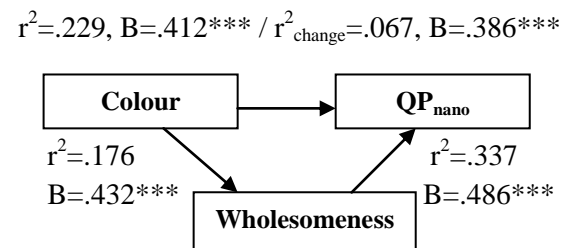
The findings derived from Czech data are summarized in below presented mediation schemes, (see Schemes 1-4):

### For a nano-wrapped product

Scheme 1

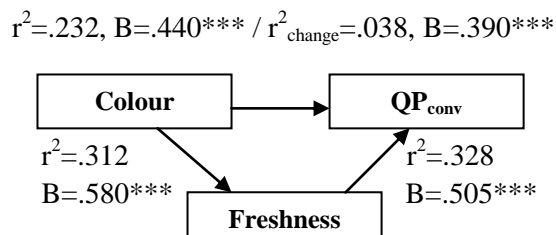


Scheme 2

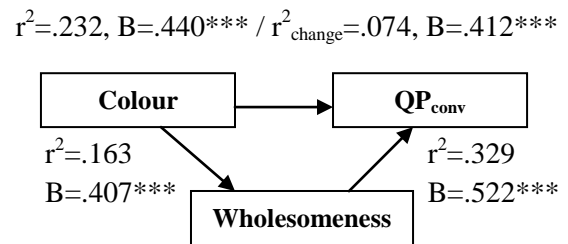


### For a conventionally-wrapped product

Scheme 3



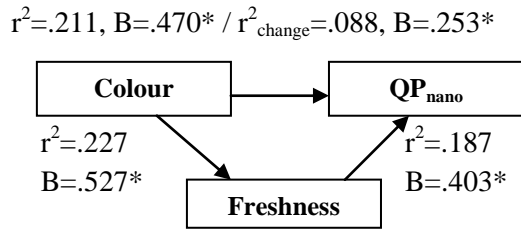
Scheme 4



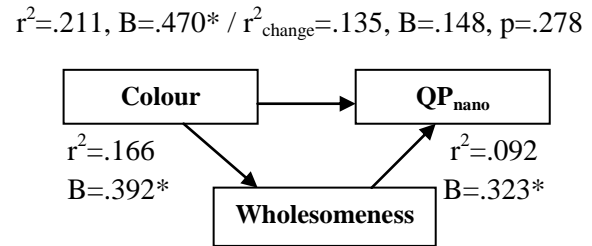
Outcomes of the mediation analysis obtained from Dutch data, (see Schemes 5-8):

### For a nano-wrapped product

Scheme 5

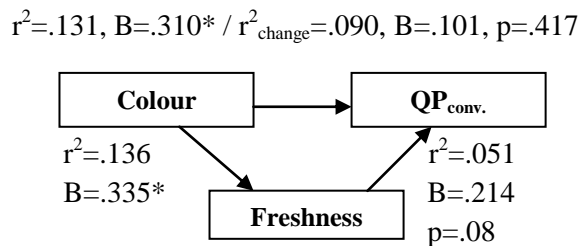


Scheme 6

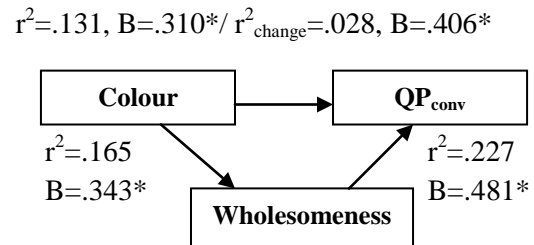


### For a conventionally-wrapped product

Scheme 7



Scheme 8



(NOTE: The coefficient of determination (change) between colour attractiveness and quality perception controlling for freshness or wholesomeness is behind the back slash sign; the significance levels are: \*\*\* $p<.001$  and \* $p<.05$ )

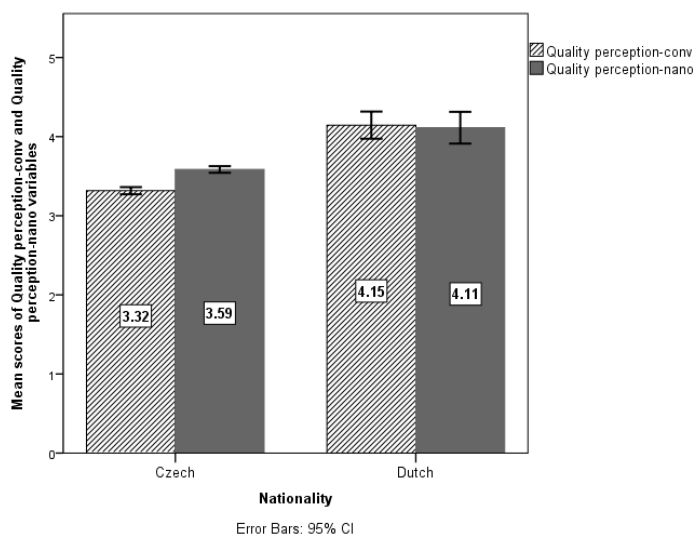
Presented mediation schemes revealed that the relationship between colour attractiveness and quality perception was partially mediated by freshness or wholesomeness in mediation schemes 1-5 and 8, where the  $B_{\text{change}}$  is significant. Partial mediation in this case means that including colour attractiveness in the model added some significant direct effect on quality perception that was not fully explained by freshness or wholesomeness. The only full mediation was shown only in Scheme 6, where the  $B_{\text{change}}$  is not significant, i.e. in case of Dutch sample the direct relationship of colour attractiveness on quality perception of nano-wrapped product is fully explained by wholesomeness perception. In the Scheme 7 the mediation was not observed because the relationship between freshness and quality perception of conventionally wrapped product is not significant. Therefore, the mediation is not likely. Other conditions of mediation were met: the colour attractiveness was a significant predictor of overall product's quality perception and of freshness or wholesomeness in all cases for both populations. Moreover, freshness or wholesomeness was a significant predictor

of overall product's quality perception while controlling for colour attractiveness, except Scheme 7.

It can be derived that Dutch respondents do not make a link between freshness and quality perception of conventionally-wrapped food product, i.e. they do not think that plastic is fresh, (see Scheme 7). On the other hand they perceive nano-wrapped product to be wholesome, (see Scheme 6). Furthermore, the regression weights are quite similar for both Czech and Dutch populations in both experimental conditions. Therefore, the process of quality perception formation is independent of experimental condition. Based the regression weights can be derived that there is a significantly positive relationship between the experience quality attribute (colour attractiveness) and credence quality attributes (freshness and wholesomeness). Both types of quality attributes are positively related with the perceived quality of particular product, except the Scheme 7, where the freshness perception is not significantly related to quality perception of a conventionally wrapped product. Thus, Hypothesis 4 could be accepted.

Subsequently, the independent samples t-tests with no equal variances assumed were

**Figure 13: Bar chart;** Quality perception of nano and conventionally wrapped products by Czech and Dutch participants



implemented on the means of quality perception. The t-test has detected that Czech and Dutch populations significantly differ on perceived quality of nano-wrapped product:  $M_{Czech}(3.59)$ ,  $SD=.738$ ;  $M_{Dutch}(4.11)$ ,  $SD=.791$ ,  $t(66.539)=-5.136, p<.001$ ; as well as on perceived quality of conventionally-wrapped product:  $M_{Czech}(3.32)$ ,  $SD=.791$ ;  $M_{Dutch}(4.15)$ ,  $SD=.674$ ,  $t(69.881)=-9.359, p<.001$ . It can be

said that Dutch respondents perceive nano and conventionally- wrapped products of higher quality than Czech participants, (see Figure 13). Moreover, the paired samples t-tests showed that Czech participants significantly differ in quality perception of nano and conventionally-wrapped fresh food products;  $M_{nano}(3.59)$ ,  $SD=.738$ ,  $M_{conv}(3.32)$ ,  $SD=.791$ ,  $t(1212)=11.710, p<.001$ . On the other hand Dutch respondents do not significantly differ in the quality perception of nano and conventionally-packed products,  $M_{nano}(4.11)$ ,  $SD=.791$ ,

$M_{\text{conv}}(4.15)$ ,  $SD=.674$ ,  $t(61)=-.322$ ,  $p=.748$ . Thus, it can be said that Czech participants perceived the nano-wrapped fresh food product of higher quality than the conventional alternative. Dutch respondents did not significantly differ on this dimension; therefore it is not possible to infer which product was perceived of higher quality, (see Figure 13).

### **Individual consumer uncertainty**

Hypothesis 5 presumes that high quality perception lowers the level of consumer's uncertainty with a particular product. The outcomes of simple linear regression, where dependent variable is consumer's level of uncertainty (measure by confidence in the product) and the predictor is overall product's quality perception, has revealed following: the nano-wrapped product  $F(1,1211)=564.621$ ,  $B=.765$ ,  $r^2=.318$  and  $p<.001$ ; and the conventionally-packed product  $F(1,1211)=549.972$ ,  $B=.681$ ,  $r^2=.312$  and  $p<.001$  for Czech participants. In case of Dutch respondents the outcomes were following: for the nano-wrapped product  $F(1,59)=19.371$ ,  $B=.679$ ,  $r^2=.247$  and  $p<.05$ ; for conventionally wrapped product  $F(1,57)=14.111$ ,  $B=.389$ ,  $r^2=.189$  and  $p<.05$ .

The findings confirmed that both models for nano and conventionally-wrapped product are able to predict the outcome variable (individual level of uncertainty with a product) in both populations. Furthermore, based on significantly positive B values between variables of interest it is possible to say that with increasing quality perception the consumer's confidence increases as well, (i.e. the uncertainty decreases). Thus, Hypothesis 5 could be accepted. (**Note:** Differences between populations on the individual uncertainty dimension are examined in Hypothesis 1, see page 33)

### **Social trust**

Hypothesis 6 presupposed that consumers who are less uncertain (more confident) with a particular product, (e.g.: an innovation) will tend to trust the source of social trust more. This hypothesis examined relationships between 2 variables: a dependent variable (social trust) and independent variable (individual level of uncertainty). Therefore, simple linear regression was considered to be the most suitable statistical tool to test this hypothesis. The outcomes derived from Czech data were following:  $F(1,1211)=78.913$ ,  $B=.236$ ,  $r^2=.061$ ,  $p<.001$  for nano-wrapped product and  $F(1,1211)=53.445$ ,  $B=.203$ ,  $r^2=.042$ ,  $p<.001$  for conventionally-packed product. In case of Dutch population the findings were:  $F(1,59)=.575$ ,  $B=.090$ ,  $r^2=.010$ ,  $p=.451$  for nano-wrapped products and  $F(1,57)=.486$ ,  $B=.147$ ,  $r^2=.008$ ,  $p=.497$  for conventionally-packed product.



The results have revealed that the model is able to predict the outcome variable (social trust) only for Czech population because the outcomes of Dutch population are not significant. This is caused by the small sample of Dutch respondents that consequently causes lack of power to explain given relationship. Based on significantly positive regression weights, derived from Czech population, it can be observed that lower individual uncertainty (higher confidence in a product) lead to an increase the trust in the source of social trust. Thus, Hypothesis 6 could be partially accepted, i.e. only for Czech population.

### Trust Manipulation

While proceeding with the second part of the conceptual model, it was necessary to assess whether the manipulation of the social trust variable (the trust in retailer's purchase advice) was successful. The ANOVA analysis between independent factor variable (trust manipulation by a story-telling) and dependent variable represented by (trust in retailer's purchase advice) was done. The results revealed that there is a significant effect of trust manipulation on the social trust:  $F(1,1211)=88.967$ ,  $p<.001$  for Czech population and  $F(1,60)=5.244$ ,  $p<.05$  for Dutch population.

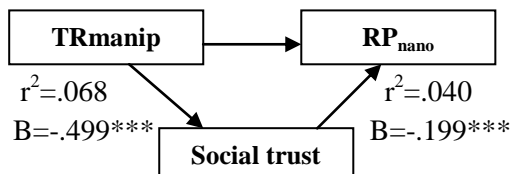
However, a process of mediation analysis was used to get more detailed information about the relationships between particular variables. The mediation analysis was based on Baron and Kenny, 1986 as described in the text related to quality perception, (see page 36).

The findings derived from Czech data are summarized in below presented mediation schemes, (see Schemes 9-12).

### For a nano-wrapped product

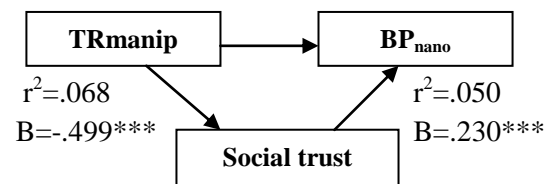
Scheme 9

$$r^2=.003, B=.108^* / r^2_{\text{change}}=.000, B=-.198^{***}$$



Scheme 10

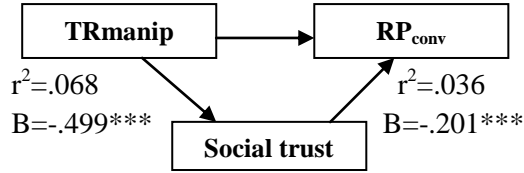
$$r^2=.003, B=-.111^* / r^2_{\text{change}}=.000, B=.230^{***}$$



## For a conventionally-wrapped product

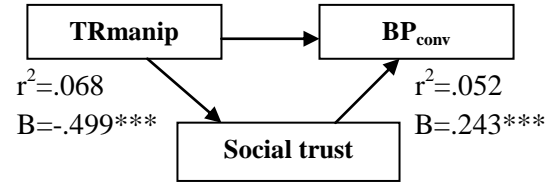
**Scheme 11**

$r^2=.003$ ,  $B=.112$ ,  $p=.054$  /  $r^2_{\text{change}}=.000$ ,  $B=-.199^{***}$



**Scheme 12**

$r^2=.001$ ,  $B=-.063$ ,  $p=.285$  /  $r^2_{\text{change}}=.001$ ,  $B=.252^{***}$

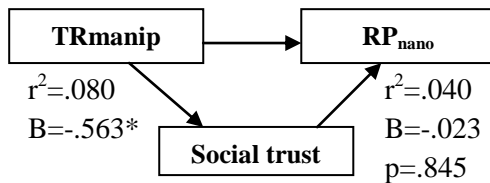


Outcomes of the obtained from Dutch data, (see Schemes 13-16):

## For a nano-wrapped product

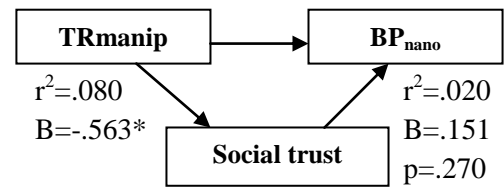
**Scheme 13**

$r^2=.006$ ,  $B=.140$ ,  $p=.543$  /  $r^2_{\text{change}}=.006$ ,  $B=-.004$ ,  $p=.972$



**Scheme 14**

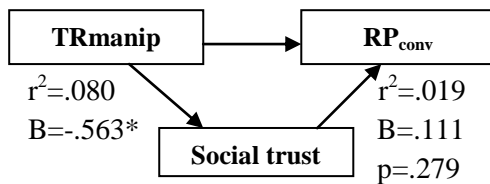
$r^2=.011$ ,  $B=.220$ ,  $p=.419$  /  $r^2_{\text{change}}=.023$ ,  $B=.199$ ,  $p=.165$



## For a conventionally-wrapped product

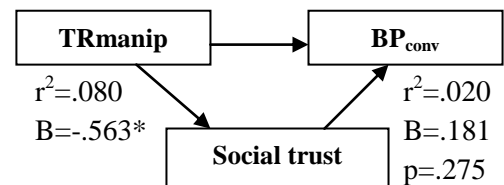
**Scheme 15**

$r^2=.032$ ,  $B=-.285$ ,  $p=.162$  /  $r^2_{\text{change}}=.021$ ,  $B=.077$ ,  $p=.472$



**Scheme 16**

$r^2=.078$ ,  $B=.713$ ,  $p=.018$  /  $r^2_{\text{change}}=.111$ ,  $B=.307$ ,  $p=.063$



(NOTE: The coefficient of determination (change) between TRmanip and RP or BP controlling for Social trust is behind the back slash sign; the significance levels are: \*\*\* $p<.001$  and \* $p<.05$ )

The mediation was not observed in Schemes 11-16, where either one or both direct effects, (Social trust and RP or BP of particular product, TRmanip and Social trust), were not significant. The partial mediation was shown only in Schemes 9 and 10 but since the  $r^2_{\text{change}}$  are 0 the mediation is negligible. The relationship between trust manipulation and social trust is significant in all cases for both populations. Above mediation schemes illustrate that

manipulation of social trust variable by story-telling was successful. On the other hand the trust manipulation did not cause changes in other variables.

### Risk and benefit perception

Social trust (ST) is assumed to be an important tool in minimizing level of consumer's uncertainty as well as risk perception with the innovation. Thus, Hypothesis 7a assumed that increase in the ST will lead to decrease in the perceived amount of risk with particular product. Hypothesis 7b continued in similar way that an increase in ST leads to increase in the amount of perceived benefit. Moreover, hypothesis 7c expected that the whole process of consumer's uncertainty and RP reduction will be fully mediated by the ST.

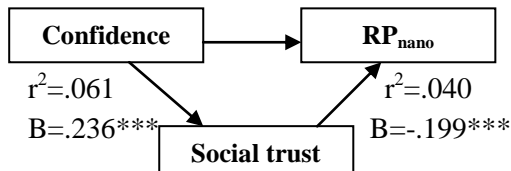
To be able to assess Hypotheses 7a, 7b and 7c it was necessary to choose slightly different procedures for Czech and Dutch population. Based on results of trust manipulation, (see pages 40 and 41), it was possible to apply another mediation analysis for Czech population. On the other hand Dutch data had to be tested with the use of regression analysis between particular variables since the relationships between ST and RP or BP were not significant.

The outcomes for Czech population are following, (see Figures 17-20):

#### For a nano-wrapped product

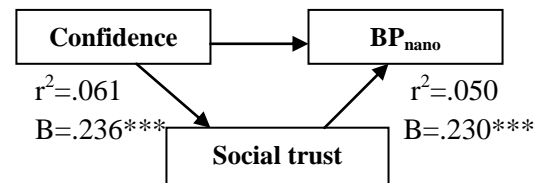
Scheme 17

$$r^2=.247, B=-.476*** / r^2_{\text{change}}=.214, B=-.081*$$



Scheme 18

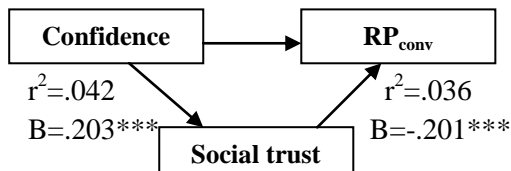
$$r^2=.215, B=.451*** / r^2_{\text{change}}=.177, B=.120***$$



#### For a conventionally-wrapped product

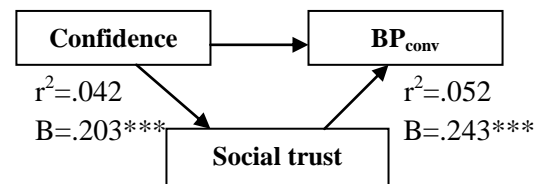
Scheme 19

$$r^2=.196, B=-.464*** / r^2_{\text{change}}=.170, B=-.109***$$



Scheme 20

$$r^2=.099, B=.322*** / r^2_{\text{change}}=.075, B=.182***$$



(NOTE: The coefficient of determination (change) between individual uncertainty (measured by confident in particular product) and RP or BP, controlling for social trust is behind the back slash sign; the significance levels are: \*\*\* $p < .001$ , \* $p < .05$ )

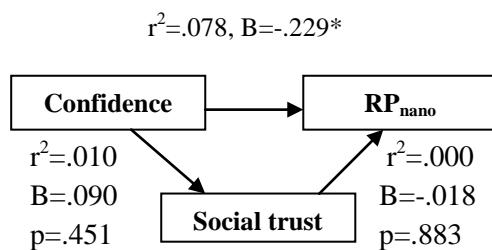
It was shown that both direct effects, (confidence – risk or benefit perception; social trust - risk or benefit perception), were significant. Moreover, significant  $B_{\text{change}}$  demonstrated the partial mediation in all cases for Czech population. This means that the direct effect between individual uncertainty, (measured by individual confidence), and risk or benefit perception related to particular product were not fully explained by the social trust variable.

Based on significantly positive regression weights between social trust and benefit perception and significantly negative regression weights between social trust and RP, Hypotheses 7a and 7b could be accepted. Moreover, since the mediation was partial in all cases Hypothesis 7c has to be rejected. The partial mediation signalize that the relationship between individual uncertainty and RP or BP is not solely explained by the social trust; i.e. the relationship will be explained better by variables that were not included in the conceptual framework.

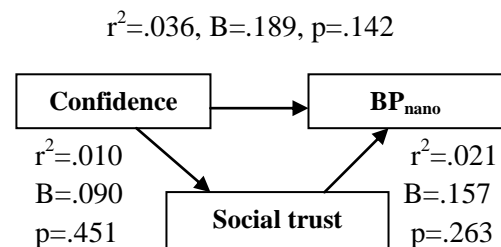
As mentioned above Dutch data had to be analysed with measurement of particular direct effects among variables, (see Schemes 21-24). The results are following:

### For a nano-wrapped product

Scheme 21

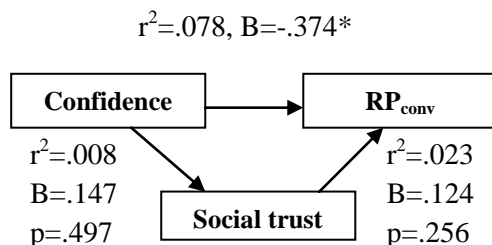


Scheme 22

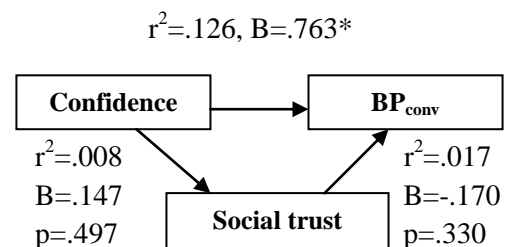


### For a conventionally-wrapped product

Scheme 23



Scheme 24



(Note: the significance level is  $*p<0.05$ )

Since all B's between the individual uncertainties (measured by individual confidence); social trust and risk or benefit perception related to given product are not significant, Hypotheses 7a, 7b and 7c could not be assessed and have to be rejected for Dutch population. On the other hand the individual level of uncertainty, (measured by consumer's confidence in particular product), had significant direct effect on risk and benefit perception related to a certain product, except Scheme 22.

### Innovation acceptance

Last two Hypotheses 8a and 8b deal with following idea: if the consumers perceive higher risk than benefit, the possibility to accept the innovation decreases. In case consumers perceive the innovation as more beneficial they will be more willing to accept it. Both hypotheses were tested with the use of multiple linear regression, where dependent variable is acceptance of an innovation (measured by likelihood to buy given product (LTB)) and independent variables are represented by risk and benefit perception. Outcomes for Czech population were following:  $F(2,1210)=473.162$ ,  $r^2=.439$ ,  $p<.001$  for nano-wrapped product; and  $F(2,1210)=237.589$ ,  $r^2=.282$ ,  $p<.001$  for conventionally-packed product. Results for Dutch population are as follows:  $F(2,58)=7.308$ ,  $r^2=.201$ ,  $p<.05$  for nano-wrapped product; and  $F(2,59)=5.167$ ,  $r^2=.149$ ,  $p<.05$  for conventionally-packed product.

**Table 3:** Regression weights between RP, BP and LTB in both nano and conventional conditions

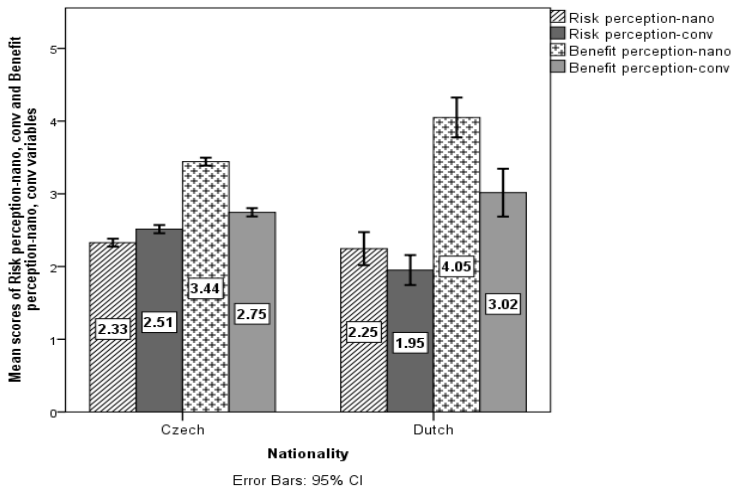
Tested variables	B coefficients	95% CI for B's	
Czech	LTB	(lower bound)	(upper bound)
RP nano	-.313	-.368	-.259
BP nano	.494	.440	.548
RP conv.	-.295	-.347	-.243
BP conv.	.327	.275	.378
Dutch	LTB	(lower bound)	(upper bound)
RP nano	-.211	-.473	.052
BP nano	.319	.101	.536
RP conv.	-.004	-.255	.247
BP conv.	.250	.093	.406

It is obvious that both models (conventional, nano) are able to predict the outcome variable (innovation acceptance) in both populations. Based on the regression weights presented in Table 3, (see page 44), it is possible to say that there is a significantly negative relationship between risk perception of both nano and conventionally wrapped fresh food product and the LTB particular product. Moreover, there is a significantly positive

relationship between benefit perception and the LTB given product. Thus, both Hypotheses 8a and 8b could be accepted.

To examine how Czech and Dutch populations differ on risk and benefit perception the means

**Figure 14: Bar chart;** risk and benefit perception of nano or conventionally wrapped products by Czech and Dutch respondents



of independent samples t-tests with no equal variances assumed were used. The outcomes of the t-tests revealed that Czech and Dutch populations do not significantly differ in risk perception of nano-wrapped product, where  $M_{Czech}(2.33)$ ,  $SD=.957$ ,  $M_{Dutch}(2.25)$ ,  $SD=.888$  and  $t(67.198)=-.703$ ,  $p=.485$  but they significantly differ in risk perception of conventionally-packed product, where  $M_{Czech}(2.51)$ ,  $SD=1.013$ ,

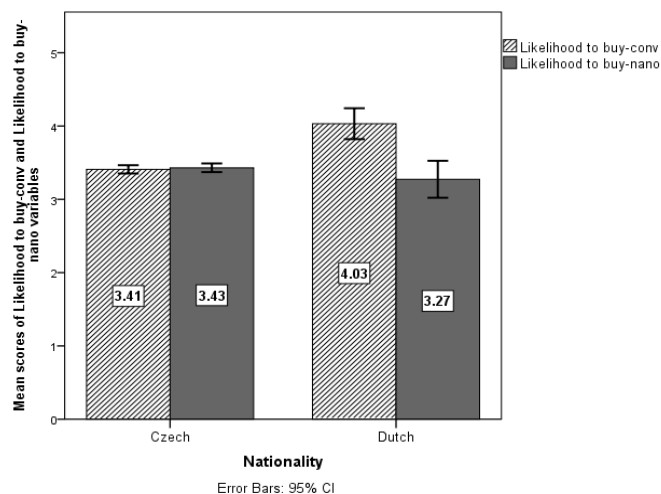
$M_{Dutch}(1.95)$ ,  $SD=.798$  and  $t(71.429)=5.337$ ,  $p<.001$ . Thus, it can be said that Czechs perceive conventionally-wrapped product with higher risk than Dutch respondents, (see Figure 14). Moreover, when the paired samples t-test was employed, it was shown that there is a significant difference in perception of risk between conventionally and nano-wrapped product for each population, (see Figure 14). It can be inferred that Czech respondents perceived higher risk with conventionally wrapped product than with nano-packed product,  $M_{nano}(2.33)$ ,  $SD=.957$ ,  $M_{conv.}(2.51)$ ,  $SD=1.013$  and  $t(1212)=-5.620$ ,  $p<.001$ . On the other hand Dutch participants perceived higher risk with a nano-wrapped product contrary to conventionally-packed product  $M_{nano}(2.25)$ ,  $SD=.888$ ,  $M_{conv.}(1.95)$ ,  $SD=.805$  and  $t(60)=-2.123$ ,  $p<.05$ .

When comparing these two populations, with the use of independent samples t-test with no equal variance assumed, on benefit perception it was revealed that: Czech and Dutch respondents significantly differed on benefit perception of nano-wrapped product  $M_{Czech}(3.44)$ ,  $SD=.957$ ,  $M_{Dutch}(4.05)$ ,  $SD=1.062$  and  $t(66.354)=-4.395$ ,  $p<.001$  but they do not differ on benefit perception of conventionally-wrapped product  $M_{Czech}(2.75)$ ,  $SD=1.019$ ,  $M_{Dutch}(3.02)$ ,  $SD=1.280$  and  $t(65.010)=-1.542$ ,  $p=.128$ . Thus, it can be said that Dutch respondents perceive more benefit with the nano-wrapped product than Czech participants, (see Figure 14)

When comparing each population on benefit dimension, it was discovered that Czech participants significantly differed on benefit perception with regard to nano and conventionally wrapped products,  $M_{\text{nano}}(3.44)$ ,  $SD=.975$ ,  $M_{\text{conv.}}(2.75)$ ,  $SD=1.019$  and  $t(1212)=20.355$ ,  $p<.001$ , i.e. Czech participant perceived more benefit with nano than conventional alternative. When examining Dutch population, it was also shown that Dutch participants differ on benefit perception of nano and conventionally wrapped product,  $M_{\text{nano}}(4.05)$ ,  $SD=1.062$ ,  $M_{\text{conv.}}(3.02)$ ,  $SD=1.280$  and  $t(61)=5.964$ ,  $p<.05$ , i.e. that Dutch participant perceive more benefit with nano-packed product as well, (see Figure 14).

When comparing Czech and Dutch populations on the likelihood to buy dimension; the independent samples t-test with no equal variances assumed revealed that there is a significant

**Figure 15: Bar chart; Likelihood to buy nano or conventionally wrapped products by Czech and Dutch respondents**



difference on LTB a conventionally-

wrapped product, where  $M_{\text{Czech}}(3.41)$ ,  $SD=1.000$ ;  $M_{\text{Dutch}}(4.08)$   $SD=.829$ ,  $t(70.398)=-5.711$  and  $p<.001$ . On the other hand Czech and Dutch respondents did not differ on LTB a nano-wrapped product, where  $M_{\text{Czech}}(3.43)$ ,  $SD=1.044$ ;  $M_{\text{Dutch}}(3.31)$   $SD=.995$ ,  $t(68.065)=1.203$  and  $p=.233$ . Thus, it can be said that Dutch respondents would be more likely to

buy conventionally-wrapped product than Czech participants, (see Figure 15). Each population was investigated on the LTB dimension individually with the use of paired samples t-tests. The outcomes were following: Czech participants did not significantly differ on the LTB nano or conventionally wrapped product  $M_{\text{nano}}(3.43)$ ,  $SD=1.044$ ,  $M_{\text{conv.}}(3.41)$ ,  $SD=1.000$  and  $t(1212)=.651$ ,  $p<.515$ ). Thus, it is not possible to say which product would be likely to be bought by Czech participants, (see Figure 15). Dutch respondents significantly differ on LTB nano or conventionally packed product ( $M_{\text{nano}}(3.31)$ ,  $SD=.995$ ,  $M_{\text{conv.}}(4.08)$ ,  $SD=.829$  and  $t(61)=-5.443$ ,  $p<.001$ ). It is clear the Dutch participants would be more likely to buy a conventionally-wrapped product than the nano-packed alternative, (see Figure 15).

## VI. Discussion

### Summary of results

Cultural national uncertainty avoidance dimension influence consumer's individual uncertainty with an innovation, i.e. a consumer who lives in a society that scored high on the CNUA dimension (The Czech Republic) perceives higher level of personal uncertainty with the innovation than consumers from society with lower CNUA score (The Netherlands). Hypothesis 1 was supported by the results, that Czech respondents perceived more individual uncertainty with the novel nano-wrapping than Dutch participants.

Quality perception plays important role in the process of consumer's purchase decision-making. The overall quality perception is being derived from quality attributes related with a product. (Steenkamp, 1999) It was shown that the green colour of the nano-wrapped food product (experience quality attribute) was positively associated with perception of freshness or wholesomeness (credence quality attribute), and thus had a positive effect on the freshness or wholesomeness perception itself. Hypothesis 2 was valid for both populations.

Since the credence quality attribute is hardly to be experienced directly by the consumer, which means it has to be trusted, a certain amount of uncertainty emerges. (Ronteltap et al., 2007) Based on the fact that consumers differ on the level of individual uncertainty with an innovation, it was revealed, that they also differ in the way they perceive the credence quality attribute. The outcomes of the research demonstrated that Czech respondents from society with higher CNUA score perceived the credence quality attribute of lower level, (i.e. less fresh and less wholesome), than Dutch participants from lower CNUA society, (Hypothesis 3).

Hypothesis 4 met the assumption that the colour attractiveness of the nano-wrapped product (experience quality attribute) was positively related with perceived freshness or wholesomeness (credence quality attribute), and subsequently these two quality attributes had a positive effect on the innovations' overall quality perception.

In Hypothesis 5, it was expected that high quality perception lowers individual consumer's uncertainty with the innovation. Hypothesis was statistically confirmed for both populations.

The overall process of innovation acceptance is based on uncertainty reduction. This was proposed with following background - Vishnawath, 2003. Therefore, it was reasoned that decrease in the level of individual consumer's uncertainty with an innovation will lead to



increase in the social actor trust. Hypothesis 6 was accepted for the Czech population but not for the Dutch population, probably because of the lack of power.

Social trust was assumed to decrease consumer's uncertainty as well as risk perception with an innovation (Rontletap et al., 2007). Hypothesis 7a which says that increase in the social trust will lead to decrease in risk perception, and following Hypothesis 7b that increase in the social trust will lead to increase in the benefit perception were statistically significant only for Czech population. In case of the Dutch population it was not possible to examine these hypotheses probably due to the power issue. Hypothesis 7c was rejected for both populations. Thus, it is clear that the process of uncertainty and risk perception reduction was not fully explained by the social trust.

Lastly, it was predicted that higher risk perception will lead to decrease in innovation acceptance, (Hypothesis 8a), and in contrary, the higher benefit perception will lead to increase in innovation acceptance, (Hypothesis 8b). The findings were in accordance with both hypotheses.

The study aimed at comparing two different populations. Many effects found for the Czech were not observed for the Dutch. However, this may be largely caused by the difference in effect size, i.e. that Czech sample size is much bigger than Dutch sample size. Thus, have more power to explain relationships between studied variables.

## **Reflections on results**

It was demonstrated that the society consumers live in influence individual uncertainty with an innovation, similarly to Steenkamp et al., 1999. The difference in uncertainty was reflected in the concept of general trust in the new food products. However, contrary to expectation, this is not necessarily related to neophobia and willingness to experiment with new food products. On the other hand it was shown that the innovation acceptance is independent of the national cultural uncertainty dimension of particular society contrary to Lee et al., 2007.

Furthermore, the uncertainty dimension was reflected in perception of credence quality attributes (freshness, wholesomeness), as well as in the overall quality perception (Lee et al., 2007). The study revealed that experience quality attributes and credence quality attributes interact with each other in accordance with Steenkamp, 1989 and 1990. Based on these interactions the consumers are able to infer various intrinsic qualities, similar to Becker, 2000; i.e. consumers' are able to infer from the type of package and the visual colour experience higher quality attributes, such as freshness and wholesomeness.

### **Limitations of the current study**

The cultural distinction may become less clear due to an extensive use of internet and other communication technologies. This may especially apply to the younger generation that was sampled. Although the evidence that societies differ on the cultural national uncertainty avoidance dimension was found, the uncertainty difference between individuals within The Czech republic or the Netherlands could be much bigger than between countries in general.

The study compared two populations with unequal group sizes. Therefore, it was not possible to employ means of ANOVA analysis as a tool of group means comparison. The mediation analysis of the trust manipulation revealed inconsistency in collected data.

Another significant limitation of this study was that consumers had to evaluate the experimental as well as the control product just on the basis of a picture displayed on the computer screen. The participants were bound with a visual experience of the particular product. The fact that the experimental product, (a nano-wrapped food product), was not introduced on the food market yet, could cause difficulties to evaluate the overall quality of such product. Moreover, the study examined only one control condition (a conventionally-wrapped fresh food product). As was shown during the study the perception of the conventionally-wrapped fresh food product differed significantly among Dutch and Czech participants. It could be speculated that the Czech and the Dutch differ on the extent to which they are used to the conventional wrapping.

### **Implications for future study**

Firstly, it was demonstrated that the uncertainty relates to the general trust in new food products. On the other hand it seems not to influence the willingness to innovate. Therefore, it would be interesting to examine these findings with the use of real products in more situations with larger and comparable samples. Secondly, it would be necessary to add more reference categories (various food products as well as different types of packages) to control for limitation of conventional wrapping. Thirdly, it may be helpful to divide participants on the personal values formed by, for example other dimensions of national culture and religious affiliation.

## **VII. Conclusion**

The study has attempted to investigate and compare two different populations on the acceptance of nano-technology and its application to food packaging. It was shown that the Czech perceived nano-wrapped food product to be fresher and higher quality than the conventional wrapping. On the other hand the Dutch did not see the added value of nano-wrapping over the conventional wrapping.

Although the innovation acceptance seemed to be similar in both populations, i.e. consumers did not favour nano-wrapped food product in either population, the position of nano-package introduction would be better for Czech food market because the added benefit of freshness and overall quality perception is stronger for Czech than Dutch consumers.

## **VIII. APPENDIX 1**

Questions used in the questionnaire were based on studies of various researchers, as follows:

- Feelings- Jordan, 1997
- Experience quality attribute, Bredahl et al., 1998
- Credence quality attributes - Bredahl et al., 1998
- Individual Uncertainty - Siegrist et al, 2007b
- Quality Perception - Lee, 2007
- Social Trust - Eiser et al., 2002
- Risk perception Sigriest et al., 2007b, Poortinga and Pidgeon, 2005
- Perceived benefit- Poortinga and Pidgeon, 2005
- Behavioural intentions - Product Acceptance, Lee, 2007

## **IX. APPENDIX 2**

### **Dutch version of the questionnaire**

Geachte deelnemer,

door middel van deze vragenlijst willen wij te weten komen hoe consumenten reageren op de toepassing van nieuwe technologie in de voedingsindustrie. De vragen gaan over oude en nieuwe vormen van technologie voor het verpakken van voedselproducten.

**LEEST U A.U.B. EERST DE VOLGENDE TEKST VOORDAT U AAN DE VRAGEN BEGINT!**

**DE TEKST BEVAT ALGEMENE INFORMATIE OVER NIEUWE TECHNOLOGIE EN DE TOEPASSING DAARVAN IN DE VOEDINGSINDUSTRIE.**

Dank u!

#### **Algemene informatie over nanotechnologie**

Nanotechnologie betreft de productie, manipulatie en toepassing van materie met een structuur op nanoniveau. Om zulke kleine fysische dimensies te kunnen begrijpen, is het misschien handig om een vergelijking te maken: 1 nanometer is 80.000 keer kleiner dan een menselijke haar. Het manipuleren van fysisch materiaal op dit niveau maakt de productie mogelijk van nieuwe of verbeterde eigenschappen van bestaand materiaal. Dit resulteert in betere chemische, fysische en elektrische reacties van een bepaalde materie.

Deze technologie wordt al gebruikt op verschillende terreinen van menselijke activiteit, zoals op medisch gebied, in de cosmetische industrie, op sportief en militair gebied, bij productieprocessen en ook in de landbouw- en voedingsindustrie. Binnenkort wordt de nieuwste innovatie op voedselgebied verwacht: de nano-verpakking.

#### **Algemene informatie over nano-verpakking**

Nano-verpakking heeft nieuwe of verbeterde eigenschappen op fysisch, mechanisch en chemisch gebied, namelijk: een betere bescherming tegen gassen en vocht; betere bescherming tegen beschadiging of breuken, en anti-bacteriële en zelfreinigende

eigenschappen. Deze kenmerken van nano-verpakking zullen de houdbaarheid van voedingsproducten aanmerkelijk verlengen. Tevens is bij het productieproces minder materiaal nodig voor de verpakking. Door het gebruik van nano-verpakking is het ook mogelijk een betere kwaliteitscontrole uit te voeren door het gebruik van speciale nano-sensors, die op de buitenkant van de nano-verpakkingen zijn aangebracht.

Nano-verpakking wordt vaak in verband gebracht met publicaties over zich vrij bewegende nano-deeltjes, welke in het voedsel terecht kunnen komen en schade zouden kunnen veroorzaken aan levende organismes. Wetenschappers, politici en producenten schieten helaas nog tekort in het publiceren van begrijpelijke regels en voorschriften, waarin zij hun visie omtrent deze nieuwe technologie kunnen weergeven.

De volgende vragen betreffen de onderstaande afbeelding van komkommers in nano-verpakking. Houd deze afbeelding s.v.p. in gedachte tijdens het beantwoorden van de volgende vragen. Dank u

**Afbeelding: komkommers in nano-verpakking**



**Wat voor gevoelens roept dit product bij u op?**

- |                       |                       |                                |                       |                       |
|-----------------------|-----------------------|--------------------------------|-----------------------|-----------------------|
| zeer positief         | positief              | niet positief niet<br>negatief | negatief              | zeer negatief         |
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/>          | <input type="radio"/> | <input type="radio"/> |

**Wat verwacht u van de kwaliteit van deze komkommers?**

- |                       |                       |                               |                       |                       |
|-----------------------|-----------------------|-------------------------------|-----------------------|-----------------------|
| zeer goed             | redelijk              | niet goed noch<br>niet slecht | matig                 | slecht                |
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/>         | <input type="radio"/> | <input type="radio"/> |

**Vind u de kleur van deze komkommers aantrekkelijk?**

zeer aantrekkelijk	enigszins aantrekkelijkwel	niet onaantrekkelijk niet aantrekkelijk	enigszins onaantrekkelijk	zeer onaantrekkelijk
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Hoe vers is deze komkommer volgens u?**

zeer vers	redelijk vers	een beetje vers	niet zo vers	helemaal niet vers
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Hoe gezond is deze komkommer volgens u?**

zeer gezond	redelijk gezond	enigszins gezond	niet zo gezond	helemaal niet ongezond
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Heeft u vertrouwen in dit product, uitgaande van deze afbeelding?**

veel	een beetje	onbeslist	weinig	absoluut niet
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Denkt u dat de toepassing van nanotechnologie onveilig is voor u?**

helemaal niet riskant	niet erg riskant	een beetje riskant	riskant	zeer riskant
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Denkt u dat de**

**toepassing van nano-technologie nuttig kan zijn voor u?**

zeer nuttig	nuttig	een beetje nuttig	niet zo nuttig	totaal niet nuttig
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Afgaande op bovenstaande afbeelding: als deze komkommer te koop was in uw supermarkt, hoe groot is de kans dat u hem zou kopen?**

zeer waarschijnlijk	waarschijnlijk	niet onwaarschijnlijk niet waarschijnlijk	onwaarschijnlijk	zeer onwaarschijnlijk
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

De volgende vragen hebben betrekking op de hieronder getoonde afbeelding van in plastic verpakte komkommers. Houd deze afbeelding s.v.p. in gedachte bij het beantwoorden van de volgende vragen.

**DankU Afbeelding: komkommers in plastic verpakte**



**Wat voor gevoelens roept dit product bij u op?**

zeer positief	positief	niet positief negatief	negatief	zeer negatief
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Wat verwacht u van de kwaliteit van deze komkommers?**

zeer goed	redelijk	niet goed slecht	matig	slecht
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Vind u de kleur van deze komkommers aantrekkelijk?**

zeer aantrekkelijk	enigszins aantrekkelijk	niet onaantrekkelijk niet aantrekkelijk	enigszins onaantrekkelijk	zeer onaantrekkelijk
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



**Hoe vers is deze komkommer volgens u?**

zeer vers      redelijk vers      een beetje vers      niet zo vers      helemaal niet vers

☐      ☐      ☐      ☐      ☐

**Hoe gezond is deze komkommer volgens u?**

zeer gezond      redelijk gezond      enigszins gezond      niet zo gezond      helemaal niet gezond

☐      ☐      ☐      ☐      ☐

**Heeft u vertrouwen in dit product, uitgaande van deze afbeelding?**

veel      een beetje      onbeslist      weinig      absoluut niet

☐      ☐      ☐      ☐      ☐

**Hoe veilig of onveilig denkt u dat plastic verpakking is?**

helemaal niet riskant      niet erg riskant      een beetje riskant      riskant      zeer riskant

☐      ☐      ☐      ☐      ☐

**Vind u het nuttig dat voedingsproducten in plastic worden verpakt?**

zeer nuttig      nuttig      een beetje nuttig      niet zo nuttig      totaal niet nuttig

☐      ☐      ☐      ☐      ☐

**Afgaande op bovenstaande afbeelding: als deze komkommer te koop was in uw supermarkt, hoe groot is de kans dat u hem zou kopen?**

zeer waarschijnlijk      waarschijnlijk      niet onwaarschijnlijk      onwaarschijnlijk      zeer onwaarschijnlijk

☐      ☐      ☐      ☐      ☐

Uw plaatselijke supermarkt is een actie begonnen om klanten aan te moedigen komkommers in nano-verpakking te kopen in plaats van komkommers in plastic verpakking.

**Hun leuze is:** “Koop komkommers in nano-verpakking, voor gegarandeerde versheid”.

**Geeft de plaatselijke supermarkt volgens u betrouwbare informatie?**

helemaal eens      eens      niet oneens      oneens      helemaal oneens

☐      ☐      ☐      ☐      ☐

**OR**

Uw plaatselijke supermarkt is een actie begonnen om klanten aan te moedigen komkommers in nano-verpakking te kopen in plaats van komkommers in plastic verpakking.

**Hun leuze is:** ‘‘Koop komkommers in nano-verpakking, voor gegarandeerde versheid’’.

**Geeft de plaatselijke supermarkt volgens u betrouwbare informatie?**

helemaal eens	eens	niet eens	niet eens	oneens	helemaal oneens
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Gelooft u dat nano-verpakkingen bestaan?**

ja, het bestaat	waarschijnlijk wel	misschien	waarschijnlijk niet	nee, zeker niet
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Bent u veel op zoek naar nieuwe of andere voedselproducten?**

altijd	vaak	soms	af en toe	helemaal niet
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Vertrouwt u nieuwe voedselproducten?**

heel erg	enigszins	onbeslist	niet zo erg	helemaal niet
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Bent u bang om iets te eten, wat u nog nooit eerder heeft gehad?**

absoluut wel	over het algemeen wel	soms wel / soms niet	over het algemeen niet	absoluut niet
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Wat is uw nationaliteit?**

**Bent u...**

man	vrouw
<input type="radio"/>	<input type="radio"/>

**Wat is uw leeftijd?**

18-21   22-25   26-29   30-33   34+

☐☐☐☒☐

**Welk studieprogramma volg je (bijv. MME, BBN etc.)**

## **Czech version of the questionnaire**

**Vážený pane/ Vážená paní,**

tento dotazník byl vytvořen za účelem pochopení vnímání nové technologie spotřebitelem v potravinářském sektoru. Celý dotazník se skládá z otázek, které se týkají nové a staré formy potravinářské obalové technologie.

**PROSÍM, PŘEČTĚTE SI NÍŽE UVEDENÝ TEXT POPISUJÍCÍ NOVOU TECHNOLOGII A JEJÍ POUŽITÍ V POTRAVINÁŘSKÉM ODVĚTVÍ DŘÍVE NEŽ ZAČNETE ODPOVÍDAT NA JEDNOTLIVÉ OTÁZKY.**

**Velice Vám děkuji!**

### **Obecné informace o nanotechnologii:**

Nano-technologie se zabývá výrobou nových látek, jejich manipulací a aplikací struktur na nano úrovni. Pro pochopení tohoto malého fyzikálního rozměru je dobré provést následující srovnání: 1 nanometr je 80,000 krát menší, nežli je 1 lidský vlas. Manipulace hmoty v tomto měřítku umožňuje výrobu nových nebo zlepšení vlastností stávajících materiálů, např.: zvýšení chemické, fyzikální a elektrické reaktivity dané látky.

Tato technologie již byla zavedena v různých oblastech lidské činnosti, např.: lékařství, kosmetika, sport, vojenství, výrobní průmysl, ale také i v zemědělsko-potravinářském odvětví. Nejvíce očekávanou novinkou, která v blízké budoucnosti vstoupí na trh s potravinami je nano-obal.

### **Obecné informace o nano-obalu**

Nano-obal bude mít vylepšené nebo nové fyzikální, mechanické a chemické vlastnosti, např.: bude sloužit jako lepší bariéra proti vlhkosti a působení různých plynů, bude mít zlepšenou tahnou pevnost a bude také disponovat antibakteriálními a samočisticími funkcemi. Tyto vlastnosti nano-obalu povedou k výraznému prodloužení data spotřeby daného výrobku. Výroba obalu bude vyžadovat menší množství použitého materiálu. Nano-obal umožní lepší sledování a kontrolování kvality potravin díky použití speciálních nano-sensorů zabudovaných na povrchu obalu.

Nano-obal je často spojován s otázkou týkající se volně se pohybujících nano-částic, které se mohou přenést z obalu do potravinového produktu a způsobit tak újmu organismu. Vědci,

politici a výrobci postrádají ucelené pravidla a předpisy, které by sjednotily jejich postoje k této nové technologii.

**Vážený respondente,**

následující otázky se týkají níže uvedeného obrázku, který představuje salátové okurky balené v nano-obalu. Prosím, berte tento obrázek v úvahu v průběhu vyplňování dotazníku.

Děkuji.

**Obrázek:** Salátové okurky balené v nano-obalu



**Jaké pocity ve Vás produkt vyvolává?**

velmi pozitivní	spíše pozitivní	ani pozitivní ani negativní	spíše negativní	velmi negativní
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Jakou kvalitu má podle Vás tato okurka?**

výbornou	dobrou	ani dobrou ani špatnou	špatnou	velmi špatnou
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Jak atraktivní je podle Vás barva této okurky?**

velmi atraktivní	spíše atraktivní	ani atraktivní ani neatraktivní	spíše neatraktivní	velmi neatraktivní
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Zdá se vám na pohled okurka čerstvá?**

velmi čerstvá      spíše čerstvá      trochu čerstvá      není příliš čerstvá      není vůbec čerstvá

☐                      ☐                      ☐                      ☐                      ☐

**Jak zdravá je podle Vás tato okurka?**

velmi zdravá      spíše zdravá      poněkud zdravá      není příliš zdravá      není vůbec zdravá

☐                      ☐                      ☐                      ☐                      ☐

**Na základě předloženého obrázku, důvěřoval/a byste tomuto výrobku?**

určitě ano      spíše ano      nerozhodnutý/ás spíše ne      vůbec ne

☐                      ☐                      ☐                      ☐

**Považujete využití takové nano-technologie pro Vás osobně za riskantní?**

není riskantní      není příliš riskantní      trochu riskantní      spíše riskantní      velmi riskantní

☐                      ☐                      ☐                      ☐                      ☐

**Za jak prospěšné považujete toto využití nano-technologie pro Vás osobně?**

velmi prospěšné      spíše prospěšné      málo prospěšné      spíše neprospěšné      velmi neprospěšné

☐                      ☐                      ☐                      ☐                      ☐

**Na základě toho co jste viděl/a na obrázku, v případě, že by tato salátová okurka byla k dostání ve Vašem místním supermarketu, s jakou pravděpodobností byste si ji zakoupil/a?**

určitě ano      spíše ano      ani ano ani ne      spíše ne      v žádném případě

☐                      ☐                      ☐                      ☐                      ☐

Vážený respondente,

následující otázky se týkají níže uvedeného obrázku, který představuje salátové okurky v konvenčním plastovém obalu. Prosím, berte tento obrázek v úvahu v průběhu vyplňování dotazníku.

Děkuji.

**Obrázek:** Salátové okurky balené v plastovém obalu



**Jaké pocity ve Vás produkt vyvolává?**

velmi pozitivní	spíše pozitivní	ani pozitivní ani negativní	spíše negativní	velmi negativní
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Jakou kvalitu má podle Vás tato okurka?**

výbornou	dobrou	ani dobrou ani špatnou	špatnou	velmi špatnou
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Jak atraktivní je podle Vás barva této okurky?**

velmi atraktivní	spíše atraktivní	ani atraktivní ani neatraktivní	spíše neatraktivní	velmi neatraktivní
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Zdá se vám na pohled okurka čerstvá?**

velmi čerstvá	spíše čerstvá	trochu čerstvá	není příliš čerstvá	není vůbec čerstvá
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Jak zdravá je podle Vás tato okurka?**

velmi zdravá      spíše zdravá      poněkud zdravá      není příliš zdravá      není vůbec zdravá

☐      ☐      ☐      ☐      ☐

**Čistě na základě předloženého obrázku, důvěřoval/a byste tomuto výrobku?**

určitě ano      spíše ano      nerozhodnutý/ás spíše ne      vůbec ne

☐      ☐      ☐      ☐

**Považujete toto využití plastu pro Vás osobně za riskantní?**

není riskantní      není příliš riskantní      trochu riskantní      spíše riskantní      velmi riskantní

☐      ☐      ☐      ☐      ☐

**Za jak prospěšné považujete toto využití plastu pro Vás osobně?**

velmi prospěšné      spíše prospěšné      málo prospěšné      spíše neprospěšné      velmi neprospěšné

☐      ☐      ☐      ☐      ☐

**Na základě toho co jste viděl/a na obrázku, v případě, že by tato salátová okurka byla k dostání ve Vašem místním supermarketu, s jakou pravděpodobností byste si ji zakoupil/a?**

určitě ano      spíše ano      ani ano ani ne      spíše ne      v žádném případě

☐      ☐      ☐      ☐      ☐

Váš místní supermarket zahájil velkou kampaň, prostřednictvím které vyzývá své zákazníky, aby kupovali okurky balené v plastovém obalu místo okurek balených v nano-obalu.

**Tvrdí následující:** „Kupujte okurky balené v konvenčním plastovém obalu pro jejich garantovanou čerstvost.“

\*konvenční = obvyklý

**Je podle Vás informace, kterou poskytuje místní supermarket, důvěryhodná?**

rozhodně ano      spíše ano      nerozhodnutý/ás spíše ne      rozhodně ne

☐      ☐      ☐      ☐



## NEBO

Váš místní supermarket zahájil velkou kampaň, prostřednictvím které vyzývá své zákazníky, aby kupovali okurky balené v nano-obalu místo okurek balených v plastovém obalu.

**Tvrdí následující:** „Kupujte okurky balené v nano-obalech pro jejich garantovanou čerstvost.“

**Je podle Vás informace, kterou poskytuje místní supermarket, důvěryhodná?**

rozhodně ano      spíše ano      ani ano ani ne      spíše ne      rozhodně ne

☐      ☐      ☐      ☐      ☐

**Věříte, že nano-obal existuje?**

ano, existuje      pravděpodobně ano      možná      pravděpodobně ne      Ne, neexistuje

☐      ☐      ☐      ☐      ☐

**Vyhledáváte při nákupu nové a rozmanité potraviny?**

určitě ano      spíše ano      občas      spíše ne      spíše ne

☐      ☐      ☒      ☐      ☐

**Důvěřujete novým potravinovým výrobkům?**

určitě ano      spíše ano      nerozhodnutý/ás spíše ne      vůbec ne

☐      ☐      ☐      ☐      ☐

**Bojíte se jíst věci, které jste nikdy předtím neochutnali?**

ano      spíše ano      někdy      spíše ne      vůbec ne

☐      ☐      ☐      ☐      ☐

**Jaká je vaše národnost?**

**Jste...**

muž      žena

☐      ☐

**Do které z následujících kategorií spadá váš věk?**

18-21 22-25 26-29 30-33 34+

☐ ☐ ☐ ☐ ☐

**Na které fakultě studujete?**

- ☐ Fakulta agrobiologie, potravinových a přírodních zdrojů
- ☐ Provozně ekonomická fakulta
- ☐ Technická fakulta
- ☐ Fakulta životního prostředí
- ☐ Fakulta lesnická a dřevařská

## **English version of the questionnaire**

**Dear student,**

this questionnaire has been designed to understand how consumers perceive application of new technology in the food sector. The whole questionnaire consists of questions related to the new and old form of food packaging technology.

**PLEASE, READ THE TEXT BELOW BEFORE YOU PROCEED WITH QUESTIONS!**

**THE TEXT PROVIDES GENERAL INFORMATION ABOUT NEW TECHNOLOGY AND ITS APPLICATION IN THE FOOD SECTOR.**

Thank you!

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### **General information about nanotechnology**

Nanotechnology deals with matter production, manipulation and application of structures at the nanoscale level. To be able understand such small physical dimension it is useful to draw a measure comparison: 1 nanometer is 80, 000 times smaller than 1 human hair. Manipulation of physical matter at this size enables production of new or enhancing functions of existing materials. It results in higher chemical, physical and electrical reactivity of a particular matter.

This technology has been already introduced in various spheres of human activity, e.g.: medicine, cosmetics, sports, military, manufacturing industry as well as in agri-food sector. The most expected innovation that will enter the food market in the near future is the nanopackaging.

### **General information about nanopackaging**

Nanopackage will possess enhanced or new physical, mechanical and chemical functions, e.g.: better gas and moisture barriers, tensile strength, antibacterial and self-cleaning functions. These nano-package's features will significantly prolong expiration date of given food product. Package will require less amount of material used for its production. Nanopackage will enable better monitoring and controlling of the food quality with the use of special nanosensors build on the surface of the nano-package.

Nanopackage is often related with an issue of freely moving nanoparticles that can transfer into the food product and thus cause harm to living organisms. Scientists, politics and

producers are lacking of comprehensive rules and regulations that would unify their attitudes towards this novel technology.

Following questions are related to the below presented picture of nano-packed cucumbers. Please, take it into consideration while proceeding with the questionnaire.

Thank you

**Picture: Nano-packed cucumbers**



**What types of feelings does this product engender?** (very negative, rather negative, neither positive nor negative, rather positive, very positive)

**How good would you expect the quality of this cucumber to be?** ( extremely poor, poor, neither good nor bad, somewhat good, excellent)

**In your opinion, how appealing is the colour of this cucumber?** (unappealing, somewhat unappealing, neither appealing nor unappealing, somewhat appealing, very appealing)

**In your opinion, how fresh is this cucumber?** (not at all fresh, not very fresh, little bit fresh, somewhat fresh, very fresh)

**In your opinion, how wholesome is the cucumber?** (not at all wholesome, not very wholesome, a bit healthy, somewhat wholesome, extremely wholesome)

**I have confidence in this product.** (not at all, not very, undecided, somewhat, very much)

**How risky do you consider this nano-technology application to be for you personally?** (extremely risky, somewhat risky, a little bit risky, not very risky, Not at all risky)

**How beneficial do you consider this nano-technology application to be for you personally?** (Not at all beneficial, not very beneficial, a little bit beneficial, somewhat beneficial, very beneficial)

**Based on what have you seen on this picture, if this cucumber was available at your local supermarket, how likely would you be to buy it?** (Very unlikely, unlikely, neither likely nor unlikely, likely, very likely)

Following questions are related to the below presented picture of cucumbers packed in conventional plastic material. Please, take it into consideration while proceeding with the questionnaire.

Thank you



**How risky do you consider this conventional plastic package to be for you personally?** (extremely risky, somewhat risky, a little bit risky, not very risky, Not at all risky)

**What types of feelings does this product engender?** (very negative, rather negative, neither positive nor negative, rather positive, very positive)

**How good would you expect the quality of this cucumber to be?** ( extremely poor, poor, neither good nor bad, somewhat good, excellent)

**In your opinion, how appealing is the colour of this cucumber?** (unappealing, somewhat unappealing, neither appealing nor unappealing, somewhat appealing, very appealing)

**In your opinion, how fresh is this cucumber?** (not at all fresh, not very fresh, little bit fresh, somewhat fresh, very fresh)

**In your opinion, how wholesome is the cucumber?** (not at all wholesome, not very wholesome, a bit healthy, somewhat wholesome, extremely wholesome)

**I have confidence in this product.** ( not at all, not very, undecided, somewhat, very much)

**How beneficial do you consider this conventional plastic package to be for you personally?** (not at all beneficial, not very beneficial, a little bit beneficial, somewhat beneficial, very beneficial)

**Based on what have you seen on this picture, if this cucumber was available at your local supermarket, how likely would you be to buy it?** (very unlikely, unlikely, neither likely nor unlikely, likely, very likely)

Your local supermarket has started a huge campaign that encourages its customers to buy nanopacked cucumbers instead of cucumbers packed in plastic material.

They claim following: “Buy nano-packaged cucumbers for its guaranteed freshness.”

**OR**

Your local supermarket started a huge campaign that discourages its customers to buy nanopacked cucumbers instead of cucumbers packed in plastic material.

They claim following: “Buy cucumbers packed in conventional plastics for its guaranteed freshness.”

In your opinion, is the information provided by the local supermarket trustworthy? ( strongly disagree, disagree, neither agree nor disagree, agree, strongly agree)

**In your opinion, is the information provided by the local supermarket trustworthy?**  
(strongly disagree, disagree, neither agree nor disagree, agree, strongly agree)

**Do you believe that nano-package exists?** (No, it doesn't, probably not, maybe, probably yes, yes, it does)

**Are you constantly searching for new and different foods?** (Not at all, not very often, occasionally, very often, always)

**Dou you trust new food products?** (Not at all, not very much, undecided, somewhat, very much)

**Are you afraid to eat things you have never eaten before?** (\_Absolutely no, rather no, rather yes, absolutely yes)

**What is your nationality?** (Czech, Dutch, Other)

**Are you ...** (Male, female)

**What is your age?** (18-21, 22-25, 26-29, 30-33, 34+)

**What is your study field?** (Society and economy, Biology Plants and Animals, Technology, nutrition, Environment and landscape); Dutch: **What is your study program** (e.g. MME, BBN, etc.)

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