

CONSUMER ACCEPTANCE OF NANOTECHNOLOGY IN FOOD
PACKAGING TOWARDS PURCHASE INTENTION: A STUDY
OF MELAKA STATES.

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This report submitted in partial fulfilment of the requirement for the award Bachelor
Degree of Technopreneurship with honour

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DECLARITON

This declaration is to clarify that all of the submitted contents of this project are original in its figure, excluding those, which have been admitted specifically in the references. All the work process involved is from my own idea and creativity. All contents of this project have been submitted as a part of partial fulfilment of Bachelor Degree of Technopreneurship with honours. I hereby declare that this project is the work of my own excluded for the references document and summaries that have been acknowledge.

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DEDICATION

I dedicate this project to God Almighty my creator, my strong pillar, my source of inspiration, wisdom, knowledge and understanding. He has been the source of my strength throughout this program and on His wings only have I soared. I also dedicate this work to my mother – Normala binti Hasaan who has encouraged me all the way and whose encouragement has made sure that I give it all it takes to finish that which I have started and encourage me to pursue my master level. To my brother – Hafez Hashim who have been affected in every way possible by this quest. Big appreciation to my beloved supervisor and panel who had guided myself throughout the research and my course-mate that assisted me in order to accomplish my research as well. Thank you. My love for you all can never be quantified. May God bless all of you.

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ABSTRACT

In today's world, consumer lifestyle has been changed time to time. Technology has lead consumer to become a better human-mankind. Advance technology is considered as powerful technology and it important to developing country because technology is conceived able to resolve organizational problem and able to enhance economic growth especially in manufacturing industries. One of the new technology invariably being discussed is nanotechnology. There are many applications of nanotechnology that can be implemented but this researcher wants to focus on nanotechnology in food packaging. The objective of this research is to investigate the factors that influencing consumer acceptance of nanotechnology in food packaging towards purchase intention. This research was held in Melaka state. Based on theoretical framework, the independent variables are technology of Nano-food, knowledge, and trust while dependent variables are consumer acceptance of nanotechnology in food packaging towards purchase intention. The data was employed from questionnaire session, journals, articles, and internet sources (Google Scholar) and analysed by using SPSS system. The result of research indicates that, Technology of Nano-food is the most influencing factor that contribute consumer to purchase nanotechnology in food packaging. In short, the researcher found utilizing nanotechnology in food packaging more likely to be acceptance by consumers compared with integrated in food product. Therefore, consumers should be aware with the early stage of new development product that utilized nanotechnology in order to understanding the product towards their purchase intention.

Key words: Nanotechnology, Food Packaging, Technology of Nanofood, Purchase Intention.

ABSTRAK

Di dunia hari ini, gaya hidup pengguna telah berubah dari semasa ke semasa. Teknologi telah memimpin pengguna untuk menjadi manusia manusia yang lebih baik. Teknologi pendahuluan dianggap sebagai teknologi yang berkuasa dan ia penting kepada negara membangun kerana teknologi diusahakan dapat menyelesaikan masalah organisasi dan dapat meningkatkan pertumbuhan ekonomi terutama dalam industri perkilangan. Salah satu teknologi baru yang selalu dipercakapkan ialah nanoteknologi. Terdapat banyak aplikasi nanoteknologi yang boleh dilaksanakan tetapi penyelidik ini ingin memberi tumpuan kepada nanoteknologi dalam pembungkusan makanan. Objektif penyelidikan ini adalah untuk mengkaji faktor-faktor yang mempengaruhi penerimaan pengguna nanoteknologi dalam pembungkusan makanan ke arah niat pembelian. Kajian ini diadakan di negeri Melaka. Berdasarkan kerangka teoretis, pembolehubah bebas adalah teknologi makanan, pengetahuan, dan kepercayaan Nano manakala pemboleh ubah bergantung adalah penerimaan pengguna nanoteknologi dalam pembungkusan makanan ke arah niat pembelian. Data ini digunakan dari sesi soal selidik, jurnal, artikel, dan sumber internet (Google Scholar) dan dianalisis dengan menggunakan sistem SPSS. Hasil penyelidikan menunjukkan bahawa Teknologi Nano-makanan adalah faktor yang paling mempengaruhi yang menyumbang pengguna untuk membeli nanoteknologi dalam pembungkusan makanan. Pendek kata, penyelidik mendapati penggunaan nanoteknologi dalam pembungkusan makanan lebih mungkin diterima oleh pengguna berbanding dengan produk makanan bersepadu. Oleh itu, pengguna harus sedar dengan peringkat awal produk pembangunan baru yang menggunakan nanoteknologi untuk memahami produk terhadap niat pembelian mereka.

Kata kunci: Nanoteknologi, Pembungkusan Makanan, Teknologi Nanofood, Niat Pembelian

CHAPTER 1

INTRODUCTION

1.0 INTRODUCTION

This chapter explains a brief summary of the study presented by this researcher. It includes the background of study, problem statement, research question, research objective, scope of study, limitation of study and significance of study. This researcher also explicates the definition term of this research.

1.1 BACKGROUND OF STUDY

Nanotechnology is considered as key of advanced technology in the twenty-first century (Siegrist et al, 2007), and previous studies indicate that it represents vast commercial chance to capitalist and businesses (Lo et al, 2012; Tolfree, 2006; Uldrich & Newberry, 2003). The applications of nanotechnology a broad field that can be included in the fields of construction materials, cosmetic, personal care product, medicine, automotive, energy, food and so on, and it is likely to increase market of nanotechnology to worldwide by 2020; restated by BBC Research, 2015. The most adopted definition of nanotechnology is provided by world's largest of nanotechnology research: National Nanotechnology Initiative, (NNI). According to NNI, **nanotechnology** defined as “the understanding and controlling of matter at dimension between approximately 1 to 100 nanometers (nm), where unique phenomena enable novel application not feasible when working with bulk material or even with single atoms or molecules, it also involves measuring, modelling, imaging and manipulating matter at this length scale”, (NNI, 2008).

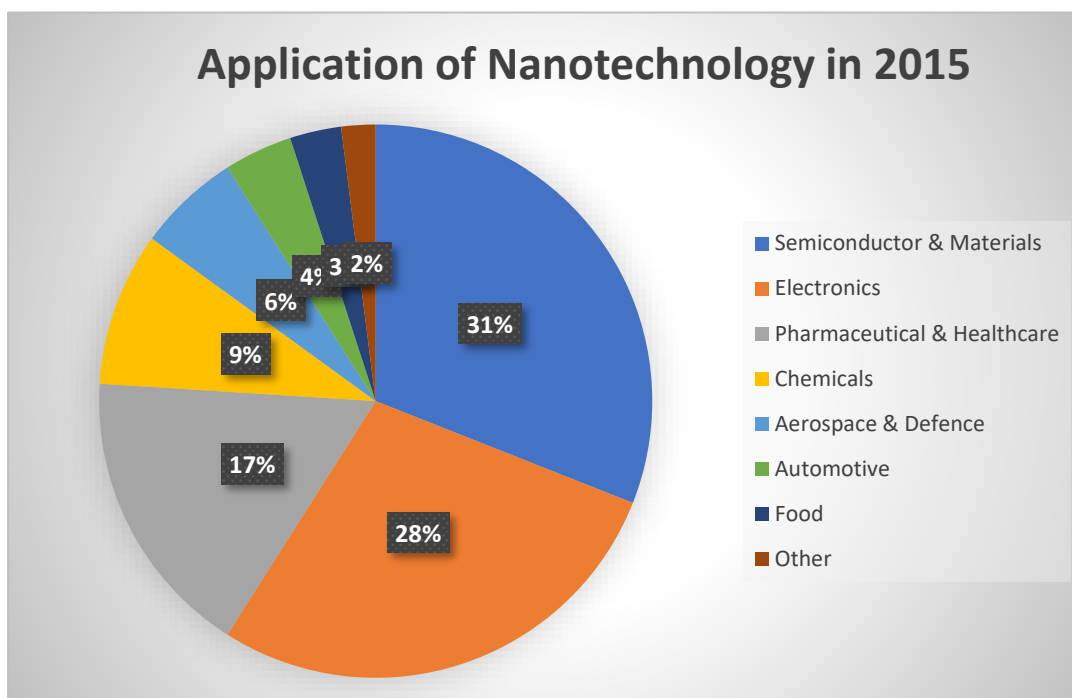


Figure 1.1: Application of Nanotechnology

The pie chart above show that the application of nanotechnology used in today's world, (Teixeira, V., 2015). It shown, food application is not the prime domain application in nanotechnology in the world. Food application in the world are still new and not being commercialized well among food industry but already proven in food application and it usage (Patel, 2002).

Nanotechnology has excellent potential in the food industry. The term “**nano-food**” is a combination of nanotechnology and food itself. Nano-food is refer to the food that already grown, produced, processed or packaging using nanotechnology tools or techniques, or has nanomaterial added into it, (Joseph & Morison, 2009). Currently available products concern four main kind of applications: (1) nanostructured food ingredient and additives, (2) nanostructured delivery system, (3) new food packaging, and (4) food contact materials for food processing and storage, (Chaudhry et al, 2008; Cushen et al, 2012; Weir et al, 2012; Mura et al, 2013). Since there have four main current available product concerns in food application, the researcher wants to focus more in food packaging application.

The term **packaging** defined as “scientific method of enclosing food material / goods in a container and it ensure delivery of good to the ultimate consumer in the best condition indented for their use” (Robertson, G. L., 2005). Packaging application where can be used to extend product shelf life, creating self-cleaning packaging and reduce packaging impact on the environment and pollution, (Sozer & Kokini, 2009). It shows that, nanotechnology is used to create products with extra health benefits to the user or better packaging for the product itself, (Kuzuma & VerHage, 2006; Sanguansri & Augustin, 2006).

The number of product utilizing nanotechnology on the market is raising, (Zhou, 2013; Chau et al, 2007; Sozwe & Kokini, 2009), the food sector maintains reluctant to adopt nanotechnology. The food sector depict a lack of perceived society urgency to bring in nanotechnology in food, (Van Dijk et al, in press) and seems to be particularly hesitant to adopt nanotechnology as the next new advanced technology. Hence, it is essential to conceive the development of consumer acceptance towards consumer's willingness to buy nanotechnology in food, and plus with commercialized and

evolution of food products may be relying on positive or negative consumer's responses, (Ronteltap et al, 2011).

Therefore, the introduction of new advanced technologies in food industries have revolutionized the efficiency of food production, but has also exerted important demand side effects that cannot be dismissed. On the contrary, in order to determine the limit of technology dissemination and transfer, it become a priority to test and disentangle which factor is the most influencing and stand behind of technology acceptance and its perception towards purchase intention. Based on the background presented, the following section will have explained more about the research problem regarding to this study.

1.2 PROBLEM STATEMENT

Over the past decades, a number of new science and technology has revolutionised in the manufacturing industries. New technologies are raising up and improved technology performance and business production. One of the technology implement is nanotechnology. There are many application of nanotechnology, but this chapter will be more focus on nanotechnology in food. Nanotechnology is now encroaching upon the food and establishing great potential in the food industry. However, the application nanotechnology in food is still new into global market.

Nowadays, nanotechnology is progressively being utilized in the area of food lines and packaging. Nanotechnology has become popular being in emerging country such as USA, European, Taiwan, and Japan (Nash, J., 2012). Even the application of nanotechnology is already popular among the emerging country but research studies depict that public awareness concerning nanotechnology is low in consumer's knowledge and lack of understanding on how it is used into food products (Cobb & Macoubrie, 2004).

The main factor of lack of understanding about nanotechnology in food because this technology is not well commercialized in specific function or even in food packaging. Previous research restates: application of nanotechnology in food packaging is already proven in term of security, detected of unwanted microorganism and improved packaging life shield but are not commercialized well in the world (Patel, 2002). These are the importance of application nanotechnology in food packing, which it able to improve food storages, bacteria identification and elimination and it can be clarify as green packaging (Paul, 2009).

In food storage, where Nano able to make sensitive food become fresher and much longer. Besides, the packing also made from antimicrobial and biodegradable (green technology), where it capable of being broken down (composed) rapidly by the action of microorganism (Paul, 2009). Many researchers were interested in studying the antimicrobial properties of organic compounds like bacteriocins, essential oils and organic acids (Schirmer et al, 2009) and use in polymeric matrices as antimicrobial

packaging. However, these compounds do not fit into the many food processing step which require high temperatures and pressure as they are highly sensitive to this physical condition and being commercialized (Galvez et al 2007; Patel, 2002). Besides, food industry is falling to take full advantages of nanotechnology because it is too expensive (Campden & Charieywood Research Association; Brittion, 2008). This is one of the factor food industries cannot enlarge the production and expand their business well in market.

Nevertheless, Malaysia is still far and left behind with this kind of technology because it still new to Malaysia expert. (Hashim, U., Nadia, E., & Salleh, S. 2008). Due to not commercialize and new in Malaysia market especially in food sector, it become hard to gain an information about nanotechnology in food and consumer's awareness is low because they are not realized of existing of this product in Malaysia market. Therefore, when consumer does not have any knowledge on how to use or utilize nanotechnology, it will discourage consumers' willingness and intention to purchase the Nano-product since there has no interest at all.

1.3 RESEARCH QUESTIONS

There are two research question that have been constructed from problem statement by this research as per below:

- I. What factor has the most influence towards consumer acceptance?
- II. How far does consumer acceptance lead to purchase intention of Nanotechnology in food packaging?

1.4 RESEARCH OBJECTIVES

The following are research objective of this study:

- I. To determine the most influencing factors towards consumer acceptance.
- II. To measure the level of consumer acceptance towards purchase intention of Nanotechnology in food packaging

1.5 SCOPE OF STUDY

The purpose of this study is to identify the factors that influencing consumer acceptance of nanotechnology in food packaging and to measure the level of consumer acceptance towards purchase intention. Furthermore, this study predicts that some of consumers are not aware of nanotechnology in food packaging since these applications are not commercialized in Malaysia. Hence, this researcher decided to examine consumer's knowledge regarding to nanotechnology in food packaging throughout the survey conducted.

1.6 LIMITATION OF STUDY

This researcher has faced several limitations caused by a few elements during this study. Since nanotechnology has been developed well in Malaysia, a lot of application of nanotechnology can be utilize in, but the researcher wants to focus on nanotechnology in food. Due to specific scope of nanotechnology in food (food packaging), this researcher found that is hard to find the right information and data regarding to nanotechnology in food especially in food manufacturing industries. All this because nanotechnology in food (food packaging) is not commercialized in the world but it application already proven (Patel, 2002) or even in Malaysia. Based on previous study, nanotechnology in food is more likely to be accepted in food packaging rather than integrated in food product. (Emma et al., 2015). In short, this researcher strongly believed that nanotechnology in food is already existing in Malaysia but not yet commercialized in specific product among food manufacturing industries.

1.7 SIGNIFICANCE OF STUDY

This study analysed the factors that influencing consumer acceptance nanotechnology in food packaging towards purchase intention. A number of studies have tested public perception of nanotechnology and the result show that public knowledge is very limited (Cobb & Macoubrie, 2004). This is because consumers have limited knowledge about nanotechnology and know-how it can be utilized to food product. This study is important as it will explore and investigate the benefits of nanotechnology and recognize the domain factor that will be contributed to consumer willingness to buy food product with nanotechnology packaging. At the same times, it will increase consumer's knowledge and understanding towards nanotechnology in food packaging and products. Besides, nanotechnology in food are not only used to increase productivity, quality and security (improve food storage for sensitive food to become fresher, longer and safety), but also used to formulate new product with advanced qualities which able to promote health sustainable production (Paul 2009; Da Costa, 2000). It also known as green technology packaging where are made from biodegradable, which means capable to being broken down (decomposed) rapidly by microorganism (Paul, 2009). This is to ensure successful commercialization of formulate nanotechnology in food will be take action by effective national, regional and international food government and able to sell into global market (Henson et al., 2008; Cardello, Schutz, & Leshner, 2007). In the coming decade, it is predicted nanotechnology will have an enormous impact in the society. Future advances likes nanotechnology is able to streamline and reduce manufacturing cost in various significant ways (Ahmadi et al, 2014). However, acceptance and understanding of nanotechnology among consumers will be determined by consumer itself (World Innovation Forum Kuala Lumpur, 2013) whether resist or accept. So, government sector has to play their role in order to educate people, give awareness, and confirm adequate information being disseminated throughout the country. Furthermore, R&D activities in Malaysia especially in the food industry may be result in economic structure and enhance product performance that utilized nanotechnology. Thus, productive growth of new market is, however ultimately relying on consumer acceptance and buying of produced foods.

1.8 SUMMARY

The aim of the research is to explore more about application of nanotechnology in food manufacturing industry especially in food product and its packaging. Therefore, the researcher also wants to investigate what extent consumer attitudes towards nanotechnology in food and factors of consumer's willingness to purchase Nano-food or food packaging itself.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter discussed about what are the factors that influencing consumer acceptance in nanotechnology in food packaging towards purchase intention. It also discussed about what kind of food technologies defined and consumer attitudes towards food technologies. Furthermore, it also utilized Technology Acceptance Model (TAM) and model of nanotechnology acceptance in theoretical framework. This researcher also proposed suitable model that can be apply regarding to this study.