Faculty of Technology Management and Technopreneurship

ADOPTION FACTORS OF P3 SWEETENER TOWARDS ACHIEVING CONSUMER SATISFACTION

Mohamad Aidil bin Hasim

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MOHAMAD AIDIL BIN HASIM

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in fulfilment of the requirements for the degree of Master of Science
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DECLARATION

I declare that this thesis entitled “Adoption Factors of P3 Sweetener towards Achieving Consumer Satisfaction” is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : .....

Name : Mohamad Aidil bin Hasim

Date : .....

APPROVAL

I hereby declare that I have read this thesis and in my opinion this thesis is sufficient in terms of scope and quality for the award of Master of Science in Technology Management.

Signature : .....

Supervisor Name : Associate Professor Dr. Juhaini binti Jabar

Date : .....

DEDICATION

I dedicate this thesis to my precious family:

Mr. Hasim bin Wahab

&

Mrs. Normala binti Hassan

&

Mr. Adam Sukri bin Hasim

&

Mrs. Zarin Atiqah binti Hasim

"Your endless prayers, love and support have gotten me here"

ABSTRACT

Recent innovations in nanotechnology have transformed the scientific and industrial fields including the food industry and it took a number of forms. These include applications of nanotechnology in food processing, food safety, food packaging, food materials, and in the foods itself. Nanotechnology in food is also known as nanofood. P3 Sweetener is one instance of a nanofood product in Malaysia, which can enhance taste, nutritional value, food quality, and shelf life of the product. However, consumers' knowledge and understanding are still limited towards nanofood product due to resistance in technology and unfamiliarity of the context utilised. Thus, this research was carried out to identify the adoption factors affecting purchase behaviour towards consumer satisfaction. A survey was conducted and 365 answers were collected from P3 Sweetener users in Johor based upon purposive sampling plan (homogenous sampling) and this research was fully conducted quantitatively. The model was adapted from Stimulus Organism Response (SOR) and elicits four influencing factors which include knowledge, trust, perceived benefit and motivation. The findings of Exploratory Factor Analysis (EFA) has identified the four influencing factors as well structured in the scale. Based on the Multiple Regression Analysis (MRA), it has shown that trust, perceived benefit, and motivation have positive significant effects on purchase behaviour, and the most significant factor was motivation. However, knowledge was considered insignificant to purchase behaviour. Meanwhile, the finding of Hierarchical Regression Analysis (HRA) indicated that age has a moderating effect on the relationship between (knowledge and purchase behaviour) and (trust and purchase behaviour). Nevertheless, age was insignificant as a moderator for the relationships of (perceived benefit and purchase behaviour) and (motivation and purchase behaviour). Therefore, this research managed to produce a model that has an impact on the research contribution. As a result of this research, practitioners are able to understand the needs of their consumers in order to plan their marketing more strategically. Last but not least, it helps to enhance consumers understanding towards purchase behaviour of nanofood.

FAKTOR-FAKTOR PENERIMAAN P3 SWEETENER DALAM MENCAPAI KEPUASAN PENGGUNA

ABSTRAK

Inovasi terkini dalam bidang teknologi nano mengubah bidang saintifik dan perindustrian termasuk industri makanan daripada pelbagai aspek. Ini termasuk aplikasi teknologi nano dalam pemprosesan makanan, keselamatan makanan, pembungkusan makanan, bahan makanan dan dalam makanan tersebut sendiri. Selain itu, teknologi nano dalam makanan turut dikenali sebagai makanan nano. P3 Sweetener adalah satu contoh produk makanan nano di Malaysia yang dapat meningkatkan rasa, nilai pemakanan, kualiti makanan dan jangka hayat produk. Walau bagaimanapun, pengetahuan dan pemahaman pengguna terhadap produk makanan nano masih terhad disebabkan oleh penentangan terhadap teknologi dan tidak memahami konteks/situasi. Oleh itu, kajian ini dijalankan untuk mengenal pasti faktor penerimaan yang mempengaruhi tingkah laku pembelian terhadap kepuasan pengguna. Satu tinjauan dijalankan dengan mengumpulkan 365 jawapan daripada pengguna P3 Sweetener di Johor berdasarkan pelan persampelan bertujuan (persempelan homogen) dan kajian ini dijalankan secara kuantitatif. Model diadaptasi daripada Model Rangsangan Gerak Balas (SOR) yang mendapati empat faktor yang mempengaruhi iaitu pengetahuan, kepercayaan, manfaat yang diamati dan motivasi. Dapatan Analisis Faktor Eksplorasi (EFA) mengenal pasti empat faktor yang mempengaruhi distrukturkan dengan baik dalam skala yang ditetapkan. Analisis Regresi Berganda (MRA) menunjukkan bahawa kepercayaan, manfaat yang diamati dan motivasi memberikan kesan signifikan yang positif terhadap tingkah laku pembelian dan faktor yang paling penting adalah motivasi. Walau bagaimanapun, pengetahuan tidak memberikan kesan yang signifikan terhadap tingkah laku pembelian. Sementara itu, dapatan Analisis Regresi Hierarki (HRA) menunjukkan bahawa usia memberikan kesan yang sederhana terhadap hubungan (pengetahuan dan tingkah laku pembelian) dan (kepercayaan dan tingkah laku pembelian). Walau bagaimanapun, usia tidak signifikan sebagai moderator untuk hubungan (manfaat yang diamati dan tingkah laku pembelian) dan (motivasi dan tingkah laku pembelian). Kajian ini berjaya menghasilkan sebuah model yang menyumbang kepada penyelidikan. Hasil daripada kajian ini, pengamal dapat memahami keperluan pengguna mereka untuk merancang pemasaran mereka dengan lebih strategik. Akhir sekali, kajian ini dapat membantu dalam meningkatkan pemahaman pengguna terhadap tingkah laku pembelian makanan nano.

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LIST OF ABBREVIATIONS

ANF	-	Asia Nano Forum
DV	-	Dependent Variable
EFA	-	Explanatory Factor Analysis
GNI	-	Gross National Income
HRA	-	Hierarchical Regression Analysis
IDT	-	Innovation of Diffusion Theory
IV	-	Independent Variable
KMO – MSA	-	Kaiser Meyer Olkin - Measure of Sampling Adequacy
LRA	-	Linear Regression Analysis
MCAR	-	Missing Completely At Random
MESTECC		Ministry of Energy, Technology, Environment and Climate Change
MOSTI	-	Ministry of Science, Technology and Innovation
MRA	-	Multi Regression Analysis
N	-	Population Size
NMP	-	Nano Malaysia Programme
NND	-	National Nanotechnology Directorate
NNI	-	National Nanotechnology Initiative
NNIM	-	National Nanotechnology Initiatives of Malaysia
NP	-	Nanoparticles
PAF	-	Principal Axis Factoring
PEOU	-	Perceived Ease of Use
PhD	-	Doctor of Philosophy
PLS	-	Partial Least Squares
PMR	-	Penilaian Menengah Rendah
PU	-	Perceived Usefulness
R&D	-	Research and Development
SD	-	Standard Deviation
SME	-	Small and Medium Enterprises
SOR	-	Stimulus Organism Response
SPM	-	Sijil Pelajaran Malaysia
SPSS	-	Statistical Package for The Social Sciences
SRP	-	Sijil Rendah Pelajaran

STPM	-	Sijil Tinggi Persekolahan Malaysia
TAM	-	Technology Acceptance Model
TPB	-	Theory of Planned Behaviour
TRA	-	Theory of Reasoned Action
UDV	-	Ultimate Dependent Variable
UPM	-	Universiti Putra Malaysia
UTeM	-	Universiti Teknikal Malaysia Melaka
UTM	-	Universiti Teknologi Malaysia
VIF	-	Variance Inflation Factor
WTB	-	Willingness to Buy

LIST OF PUBLICATIONS

Indexed Journal

Hasim, M. A., Jabar, J., Murad, A. M., and Nazir, A. N., Ibrahim, N. F., 2020. The Association of Knowledge, Trust, Perceived Benefit and Motivation towards Purchase Behaviour: A Case of P3 Sweetener. *International Journal of Advanced Science and Technology*, 29(6S), pp.2877-2884. (Indexed by SCOPUS)

Hasim, M. A., Jabar, J., Murad, A. M., and Nazir, A. N., 2020. An Exploratory Factor Analysis on Adoption Factors of P3 Sweetener. *Test Engineering and Management*, 82, pp.9647- 9654. (Indexed by SCOPUS)

Hasim, M. A., Jabar, J., and Murad, A. M., 2019. A Preliminary Research on Consumer Acceptance in Nanofood towards Purchase Intention: A Pilot Research. *International Journal of Recent Technology and Engineering*, 8(2S3), pp.352–356. (Indexed by SCOPUS).

Hasim, M. A., Jabar, J., and Murad, A. M., 2019. Investigating Factors Influencing Consumer Adoption of Nanofood towards Purchase Intention. *International Journal of Advanced Science and Technology*, 28(15), pp.133–139. (Indexed by SCOPUS).

CHAPTER 1

INTRODUCTION

1.1 Overview

This section is a summary of the researcher's study. This includes the growth of nanotechnology in Malaysia, the application of nanotechnology, the problem statement, the research question, the research objectives, the significance of the study and the scope of the studies. In addition, it also explains the operational definitions and terms of research used in this chapter.

1.2 The growth of nanotechnology in Malaysia

Malaysia has participated in nanotechnology since early 2000, and a lot of development and revolution have been started during that year. In 2014, Malaysia was involved with the Asia Nano Forum (ANF), and subsequently, many nanotechnology conferences in Japan and Australia. Ibnu Sina Institute from Universiti Teknologi Malaysia (UTM) was established in 2005. The following year, Ibnu Sina Institute organised the Malaysian Nanotechnology Forum and at the same time hosted the ANF meeting in conjunction with the official opening of the institute. During the meeting, the formation of the National Nanotechnology Initiatives of Malaysia was proposed (Ibnu Sina Institute, 2018).

In the same year Ibnu Sina Institute was established, Dato' Seri Mohd Najib bin Tun Abdul Razak also suggested the evaluation of the National Nanotechnology Initiatives (NNI), including the National Nanotechnology Initiatives of Malaysia (NNIM). NNIM was

introduced by the Deputy Prime Minister on 19 September 2006, with the goals for maintaining the sustainable diversity of science and technology. The purposes are to incorporate with the existing nanotechnology syllabus and programmes, collaborate and plan Research and Development (R&D) activities, provide a platform for commercialisation and transfer of new technology to generate economic return for the general public, develop educational resources, skilled labour, expertise and infrastructure, as well as provide facilities and research support services (Hamdan, 2014).

Nanotechnology can help to improve and build competence of the new key economic sector that have been introduced by the government body in 2010. According to the National Nanotechnology Initiatives of Malaysia (NNIM), nanotechnology is defined as the science of materials and systems with structures and components, which display improved novel physical, chemical and biological properties and phenomena that exist in the nano-size scale (1–100 nm). NNIM was aimed to promote nanotechnology for the sustainable benefit of science, industry, technology, and the economy (Hamdan, 2014; Gibb, et al., 2018). This technology has been categorised as an advanced science and technology area to boost and guide the district industry in Malaysia (Lai and Yap, 2004; Felker and Sundaram, 2007; Hamdan, 2014). Nanotechnology activities present at the minimum 1% or about RM1.7 trillion of the Gross National Income (GNI) – estimated ranges by 2020 (Karim and Munir, 2015; Hamdan, 2014).

In 2009, the Malaysia government noticed that science and technology have a big potential as an addition mechanism for the new economic growth and policies that will induce the extension of nanotechnology in Malaysia. In 2010, the National Nanotechnology Directorate (NND) has been launched by the then Ministry of Science, Technology and Innovation (MOSTI) and is currently known as the Ministry of Energy, Science, Technology, Environment and Climate Change (MESTECC). The purpose of NND are to

synchronise the strategic plan in adoption, adaption and application in nanotechnology smoothly in a moderate process of modification and diffusion of nanotechnology to Malaysia lifestyle, which span the next 10 years. Therefore, the Tenth Malaysia Plan (10MP) for nanotechnology is recognised as the important mechanism of fiscal growth in Malaysia. The National Nanotechnology Directorate (NND) was officially launched in 2010, with particular roles, action research, and future research plans. Throughout the implementation of the NanoMalaysia Program (NMP), microbiology and nanoscience technologies will have an impact on the community in the coming years and will represent at least 1% of the Gross National Income (GNI) by 2020 (Hamdan, 2014).

In Malaysia, a growing number of producers look towards nanotechnology to enhance their products especially in nanofood. Thus, there is a need to safeguard consumers and ensure the quality of such products (Lee, 2018). The term nanofood refers to food that has been grown, produced, processed or packaged using nanotechnology tools or techniques, or has nanomaterials added into it (Sekhon, 2010; Hasim, et al., 2019). However, due to the limited utilisation of nanofood in food industries (He, Deng, and Hwang, 2019), it is difficult to discern how nanoparticles and materials have been used in food and how to adopt this technology, especially in the Malaysian industry (Wyser, et al., 2016).

Therefore, it should be the responsibility of the government to ensure that information on nanotechnology is communicated clearly and well, without having to conceal the side effects to consumers. In addition, more attention should be paid to the strengthening of nanofood policies and regulations in the future. This is to ensure that any nanofood product is reliable and safe for use without hesitation. Finally, a successful nanofood promotion campaign should be further strengthened in order to increase consumer awareness and understanding of the benefits that would be derived from the proper use of nanofood products in the future.

1.3 The application of nanotechnology

Nanotechnology can be seen as a new and fast emerging sector. Nanotechnology has the capabilities to manipulate atomic and molecular materials, systems and processes (Khan, 2014). According to Ramsden (2016), nanotechnology is defined as technology at the nanoscale. However, it is also defined as nanoparticles which have one or more magnitudes in the range of 1–100 nm and a composition of serviceable materials, technologies and infrastructure through the regulation of matter on the micrometre width scale (Mnyusiwalla, et al., 2003; Rabiee, et al., 2019). Even though the size of nanoparticles is small in chemical composition and surface structure, it has its own capabilities, strength, uniqueness, and big potential in today's applications (Khezri, Kia, and Seyedsaleh, 2016).

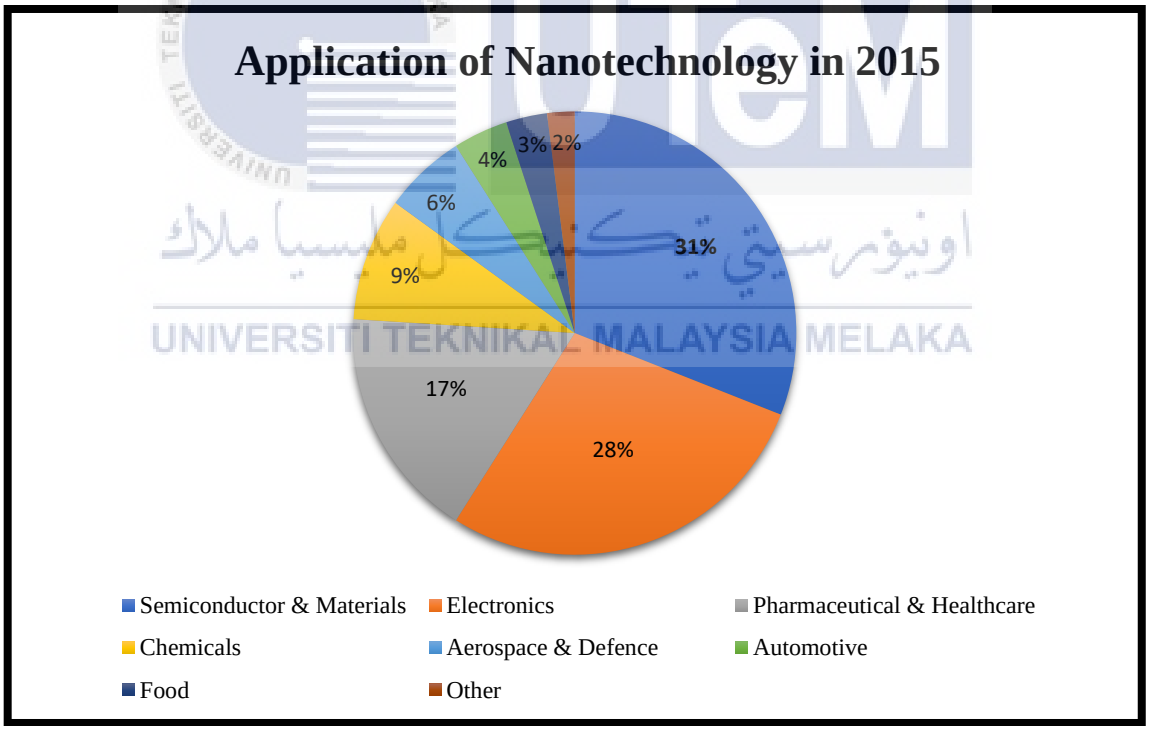

Figure 1.1: Application of nanotechnology
(Adopted from: Teixeira, 2015, p.19)

Figure 1.1 shows the application of nanotechnology in today's world. Nanotechnology has been applied in various fields, such as semiconductor and material,

electronics, pharmaceutical and healthcare, chemical, automotive, aerospace and defence, and food industry. Every use of nanotechnology has a different impact on a specific field (Bakie, 2018). Based on the report done by Teixeira (2015), the biggest industry that has utilised nanotechnology was the semiconductor and materials industry, the second highest was the electronic industry and the third was pharmaceutical and healthcare. It indicates that all these industries have contributed to the development of nanotechnology (Kokini and Sozer, 2009; Coles and Frewer, 2013).

In the context of Malaysia, a growing number of industries look towards nanotechnology to enhance their productivity from year to year, especially in the electronics and pharmaceutical and hospitality industries (Lee, 2018). Nevertheless, the application of nanotechnology to the food industry remained uncertain and has not been widely pursued due to insufficient resources and difficulties in research and development (Handford, 2015; Khezri, Kia, and Seyedsaleh, 2016). Thus, it encourages the researcher to explore more about the food industry. In addition, there is limited research on the adoption of nanofood in the context of Malaysia, which contributes to limited knowledge and understanding (Van Giesen, et al., 2018; Hasim, et al., 2019). This concern becomes a practical motivation for this researcher to further examine the application of nanotechnology to the food industry and to identify adoption factors in nanofood.

In the food industry, nanofood has been formulated with nanotechnology. Nanofood refers to the food that has been grown, produced, processed, or packaged by using nanotechnology tools or techniques or has nanomaterial added into it (Sekhon, 2010). Nanofood can enhance the development of new food formulation, improvement of food packaging materials, advanced food security devices and biosensors to ameliorate food quality indices such as shelf life, sensory characteristics, texture and health benefits (Khezri and Kia, 2016). In nanofood, nanotechnology has been used for the improvement of food