



Faculty of Technology Management and Technopreneurship

**TECHNOLOGY UTILISATION IN MALAYSIA FROM BROILER
PRODUCTION PERSPECTIVE**



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**TECHNOLOGY UTILISATION IN MALAYSIA FROM BROILER PRODUCTION
PERSPECTIVE**

NUR SHAFIZAH BINTI SHAHIDAN

**A thesis submitted
in fulfilment of the requirements for the degree of Doctor of Philosophy**



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2023

DECLARATION

I declare that this thesis entitled “Technology Utilisation in Malaysia From Broiler Production Perspective” 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.


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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 Doctor of Philosophy.

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DEDICATION

To my husband (Mohd Zaki Ismail), my daughters (Sarah Aisyah, Sofea A'qila, Sarena Zahra and Sharafina Noura), my sister (Nur Athirah Shahidan), my parents, my late father-in-law, my mother-in-law, my family and my best friends for their love, sacrifices and inspirations. I'll forever be thankful for. To Fawwaz and Noah, I'll see you in my dreams.



ABSTRACT

Technology is being utilised to increase agriculture production to sustain the supply of nutritious food to a world population that is expected to increase to 9.7 billion by 2050. However, technology utilisation is at a low level among small and medium broiler producers in Malaysia due to the hefty price tag and the depreciation of the Ringgit Malaysia in recent years. Another concerning factor is the reliance on imported corn and soybeans, which account for 95 per cent of the chicken feed mix. Any uptrend in these agricultural commodities could result in distressing consequences for Malaysian dietary intake and its economic growth because broiler meat is the primary source of protein. The Malaysian government has proposed several strategic plans to ensure that the broiler industry is able to continue as a competitive industry. Among the strategies is to strengthen broiler manufacturing activities by reassuring that modern technology is in line with good farming practices. Regardless of the fact that innovative technologies offer more profit and environmental advantages, the readiness of small and medium broiler producers to utilise technologies requires more in-depth assessments. These issues accentuate the need for sustainable broiler production to ensure continuous productivity and reduce adverse impacts on towards the environment that have long lingered within broiler production. Therefore, this research intends to investigate technology utilisation from broiler perspective and a new approach with the objective of sustaining Malaysian broiler production demands. The lack of understanding of technology utilisation in broiler production emphasises the need for thematic analysis (TA) model development. TA allows this study to systematically identify, organise, and offer insight into the patterns of meaning (themes) across a dataset. Data on broiler production from 12 broiler producers was gained through semi-structured interviews. The research investigated the issues surrounding the successful and unsatisfactory implementation of broiler production solely from Malaysian broiler producers' perspective and developed a model to explain the reasons for those issues. Thus, the qualitative findings of this research utilise the TAM3 theory by identifying constructs which play crucial roles in technology utilisation in Malaysia from broiler producers' perspective. This study found that high costs, financial institutions' negative perceptions, government policies, and a competitive market are elemental factors that affect successful Malaysian broiler production. This study also establishes that integrators (large broiler producers) with their enormous capital and larger sizes will continue to grow, but this scenario raises further concern as to the level of competitiveness and stability of Malaysian broiler industry. It is hoped that with the proposed TAM3 model, it will assist various parties involved in the broiler industry to secure sustainable broiler production in Malaysia.

PENGGUNAAN TEKNOLOGI DI MALAYSIA DARI PERSPEKTIF PENGELUARAN AYAM DAGING

ABSTRAK

Teknologi dimanfaatkan untuk meningkatkan pengeluaran hasil pertanian kerana populasi dunia dijangka akan bertambah menjadi 9.7 bilion menjelang tahun 2050. Namun penggunaan teknologi di kalangan penternak ayam daging berskala kecil dan sederhana di Malaysia adalah rendah kerana nilai mata wang negara yang tidak stabil dan nilai teknologi yang terlalu tinggi. Apa lebih membimbangkan adalah kebergantungan industri ini terhadap komoditi jagung dan kacang soya import yang merangkumi 95 peratus daripada campuran makanan dalam penternakan ayam daging. Sebarang perubahan pada harga komoditi pertanian dunia akan mendatangkan kesan yang membimbangkan terhadap pengambilan protein dalam diet harian rakyat Malaysia dan juga akan mendatangkan kesan buruk ke atas pertumbuhan ekonomi negara. Kerajaan telah menggariskan beberapa pelan strategik dalam memastikan penternakan ayam daging kekal sebagai industri yang mampu untuk terus berdaya saing. Antara strategi yang telah digariskan adalah pengenalan teknologi moden beserta amalan pertanian yang baik. Walaupun penggunaan teknologi menjanjikan keuntungan dan kelebihan kepada alam sekitar, namun kesediaan penggunaan teknologi di kalangan penternak ayam daging berskala kecil dan sederhana memerlukan kajian yang lebih mendalam. Semua isu-isu ini perlu diberi perhatian bagi memastikan pengeluaran ayam daging kekal mampan dan mampu mengurangkan pencemaran terhadap alam sekitar yang telah lama membelungi perternakan ayam daging. Sehubungan itu, kajian ini dilaksanakan bagi mengkaji penggunaan teknologi dari perspektif penternak ayam daging di Malaysia. Kurang pemahaman di dalam penggunaan teknologi telah mendorong kajian ini untuk dilaksanakan melalui pembangunan model menggunakan 'Thematic Analysis (TA)'. Kaedah TA ini membantu penyelidik untuk mengenal pasti, menstruktur dan mendalami sesuatu set data secara tema dengan lebih mendalam. Data dari 12 penternak ayam daging telah diperolehi secara temuduga separa struktur dengan memberi fokus kepada isu berkaitan kejayaan dan kegagalan penternakan ayam daging di Malaysia dan sebuah model telah dibina bagi menggambarkan permasalahan tersebut. Dapatan dari kajian kualitatif ini menggunakan model TAM3 telah mengenal pasti konstruk yang memainkan peranan penting dalam penggunaan teknologi bagi penternakan ayam daging. Hasil kajian mendapati nilai teknologi yang tinggi, persepsi negatif dari institusi kewangan, polisi kerajaan dan tekanan untuk sentiasa kompetitif adalah faktor-faktor penting yang menghalang kejayaan penternakan ayam daging. Di samping itu, integrator (penternak ayam daging berskala besar) yang mempunyai sumber kewangan yang kukuh dan saiz yang lebih besar akan terus mendominasi penternakan ayam daging namun ini menimbulkan persoalan tentang tahap kompetensi dan kestabilan industri ini. Diharap, cadangan model TAM3 ini mampu untuk membantu semua pihak yang terlibat untuk bersama-sama memastikan penternakan ayam daging di Malaysia mampu untuk terus mampan dan berdaya saing.

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LIST OF PUBLICATION

Shahidan, N. S., and Othman, N. A., 2017. Technology Utilization of Malaysian Agriculture in Enhancing Food Security. In *2nd International Conference on Management In Emerging Markets (ICMEM) and International Conference On Innovation In Business And Strategy (ICIBS)*, 26-28 July 2017.

Shahidan, N. S., and Othman, N. A., 2018. A Review on Technology Utilisation of Malaysian Broiler Industry in Enhancing Food Security. *Journal of Computational and Theoretical Nanoscience*, 24(12), pp. 9419-9422.



CHAPTER 1

INTRODUCTION

1.1 Introduction

This chapter introduces the background to the research, including the challenges faced by Malaysian agricultural players, the need for technology utilisation in agriculture, and the motivation for researching this field. The research aim, objectives, and scope of research are also discussed. The organisation of the thesis is included at the end of this chapter.

1.2 Research background

The world has seen perplexing changes in population. There are currently three times more people on earth than in the early 1930s. United Nations (2019) predicted that from an estimated global population of 7.7 billion worldwide in 2019, the global population could grow to around 8.5 billion in 2030, 9.7 billion in 2050 and 10.9 billion in 2100. Food is a fundamental need for human since the beginning of time. Through agriculture, human are able to have access to various food. As time passes, agriculture is becoming more important than ever before. However, increasing population is growing problem that requires a much holistic approach.

Technological innovations have greatly shaped agriculture throughout history. Driven by the requirement to feed the ever-increasing human population, technological

innovations have been made in agricultural production. Based on a series of research, development and technology transfer initiatives occurred between the 1940s and the late 1970s, the Green Revolution saw an increase in agricultural production around the world through innovation in agricultural technologies.

Experts are finding new ways to improve food production. Latest technological innovations in food production focused on areas such as indoor vertical farming, automation and robotics, livestock technology, modern greenhouse practises, precision agriculture, artificial intelligence, blockchain, and smart farming, which are believed to provide the much-needed solutions to feed this larger, urbanised human population (Sulaiman et al., 2021).

It is true that technologies can enhance agricultural production by improving competitiveness and productivities. Additionally, agricultural technologies have the potential to reduce the impact of natural resources constraints such as land and water, provide food for the hungry, and reduce crises such as famine and starvation in many countries. However, costs associated with the latest innovation and deployment of this technology could potentially limit the widespread adoption and use in Malaysia. With the depreciation of the Ringgit Malaysia in recent years, technological innovations have become very challenging to be utilised by small and medium agricultural producers in Malaysia.

Broiler production is one of the fastest growing sectors in the Malaysian agricultural industry. Studies on broiler production in the last 40 years show that there has been an extraordinary improvement in efficiency in broiler meat production through technological innovations (Tallentire et al., 2016; Szöllősi et al., 2021). Broiler chicken is often seen as the go-to protein-based food needed in a human diet as it is cheap and accepted by all religions. Malaysia became self-sufficient in broiler meat production to meet the domestic demand

since 1984 (Elsedig et al., 2015). Although Malaysia has become self-sufficient in broiler meat production, there are serious concerns regarding the long-term sustainability of this industry.

Sustainable agriculture can be defined as the one that will meet the needs of the present while enhancing the ability of future generations to meet their needs, increasing productivity to meet future food demands, decreasing impacts on the environment, improving human health, as well as improving the social and economic activities (Samsuddin et al., 2015).

Sustainable broiler production in Malaysia is very important to meet the demand for food in the future. Sustainable production is expected to offer continuous and higher productivity as well as reduce impact towards the environment. The adverse impacts of broiler production have received increasing attention over the last few years due to its significant role in Malaysian dietary intake.

1.3 Problem statement

The broiler industry in Malaysia has an important role in the provision of protein to Malaysia's unique multi-ethnic and multi-religious population. Broiler meat has contributed more than 45 per cent of protein intake for Malaysians since 2013 (DVS, 2018). Similarly, there is no religious or cultural prohibition in relation to broiler meat consumption in comparison to beef and other types of meat. Owing to its general acceptance, strong demand, and role as an essential source of protein, this industry has successfully recorded more than 100 per cent self-sufficiency level since 1984 (Elsedig et al., 2015).

The ease of cooking has also contributed to broiler meat becoming so popular among consumers. The popularity of broiler meat in the diet of Malaysians is also reflected in the

high per capita consumption of broiler meat. The Department of Veterinary Services (DVS) (2018) asserted that Malaysians' per capita consumption of poultry meat (chicken and duck) in 2019 has increased to 50.7 kg, an increase of 1.6 kg from the previous year. Thus, poultry meat (chicken and duck) has remained the highest per capita consumption of livestock products in Malaysia since 2013.

Although Malaysians have enjoyed years of availability and accessibility of its broiler meat production, the stability of this thriving industry is still beyond control. This is prominent in the frequent shortage of supply or ridiculous price hike for broiler meat, especially during festive seasons such as Hari Raya and Chinese New Year. The lack of stability in broiler production can be especially harmful to households living in poverty (Naylor, 2014). A significant shortage of broiler meat would incur disastrous consequences in Malaysians' dietary intake and its economic growth because broiler meat is the primary source of protein.

The growing demand for food in terms of quality and quantity has increased the need for technology in agriculture. Agricultural technologies have improved production and productivity in developing countries. However, advances in agricultural technologies are ununiformed across geographic regions (Chhetri and Chaudhary, 2011).

Almost all the agricultural technologies in the Malaysian broiler industry are imported. These technologies are housing infrastructures, rearing practices, and waste management systems. The housing infrastructures, rearing practices, and pest pollution controlled technologies are the most adopted technologies due to their high conversion ratios. Accreditation, cooling system technology, and waste management systems are among the least utilised technologies by broiler players in Malaysia. The transformation of the broiler industry into a sustainable and profitable sector is a necessity to meet the higher

demand of broiler meat in the future. This leads to higher costs associated with innovation and deployment of agricultural technologies in broiler production, which could potentially limit the widespread adoption and use in Malaysia (Ferlito, 2020).

Conversely, in the context of the Malaysian broiler industry, the utilisation of technology has been prevalent with the enhancement of the housing infrastructures from open house (OH) systems to closed house (CH) systems. Over the years, the broiler industry has benefited from major structural changes with vertically integrated broiler operations that outgrew small and medium broiler producers. The replacement of small and medium broiler producers has resulted in a loss of income (Hafez and Attia, 2020).

Another reason why stability dimension is an alarming condition in the Malaysian broiler industry is its dependency on imported corn and soybeans in chicken feed mix. As Malaysia's broiler production increases, local corn producers have become unable to meet the demand from the broiler industry. Therefore, the stability of Malaysian broiler production has become dependant on the agricultural commodities imported from other countries. This dependency on food imports can cause a low broiler production if there are disturbances in the global supply commodities. High feeding costs in the broiler industry that create lesser net returns ultimately limit the inflows of investments in this industry (Rahman et al., 2003). The feed costs in broiler production contributes about 70 per cent of the total production costs; day old chicken (DOC) contributes about 22 per cent; and other costs such as labours, supplements, and equipment contribute about less than 9 per cent (Ravindran, 2013).

Agricultural production is usually seasonal in nature and is vulnerable to natural phenomena such as diseases, pests, and climate changes. Most agricultural products such as broiler chickens are perishable. All these contributing factors have depicted agricultural

investment as very risky and undesirable for financial institutions and new agricultural players. Additionally, broiler producers and financial institutions are perturbed to invest in broiler production due to the slow net returns and high initial investments that linger within the broiler industry (Abdurofi et al., 2018).

Apart from that, there remain difficulties in applying technologies in practice among Malaysian broiler producers due to the lack of policy support, regulation, funding, education, and public acceptance (Garvey, 2012). Small and medium broiler players who constitute the majority of broiler producers in Malaysian rural areas need to be able to benefit from the latest technological advances.

At present, it is doubtful whether the current approaches are enough to sustain Malaysia's broiler production. It is true that Malaysians have enjoyed years of availability and accessibility of its broiler meat production, but the stability of this industry is still beyond our control. There is always a shortage supply or price hike for broiler meat, especially during the festive seasons. Recently, Malaysians have experienced a shortage of supply and rising prices of broiler meat. The broiler meat prices have soared in recent months after a global feed shortage exacerbated by the Russia-Ukraine war that disrupted the world's production. Additionally, the Malaysian Government had put a halt to its export of 3.6 million chickens a month starting 1 June 2022 until the prices and production of broiler chickens in Malaysia stabilises.

Technology utilisation is expected to help transform Malaysia's current agricultural systems towards sustainable food production. To steer this transformation, this study seeks to understand the mechanisms of technology utilisation holistically.

The lack of understanding of technology utilisation in broiler production emphasises the requirement of a model development approach. This is achieved by transforming into

model development as a guideline from the perspective of broiler players in Malaysia. Therefore, model development is necessary for broiler production in ensuring that sustainable food production is achieved in Malaysia. For these reasons, this research seeks to understand and address the stability dimension of Malaysia broiler industry that is essential in assuring sustainability of Malaysia's food industry for the future. A summary of the thesis is presented in Figure 1.1

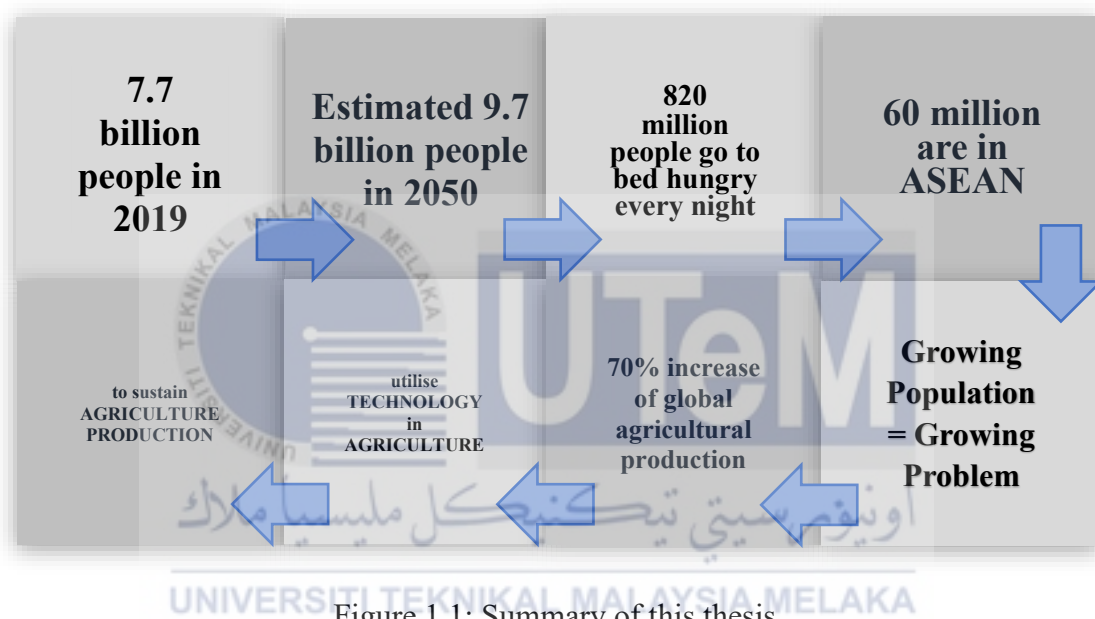


Figure 1.1: Summary of this thesis

1.4 Research aim and objectives

The principal aim of this research is to inform an understanding of how Malaysian broiler players experience technology with regard to its utilisation. The research aim, therefore, is supported by the following objectives:

- i) To explore the role of technology utilisation in agriculture;
- ii) To investigate the issues and challenges of broiler producers' difficulties in utilising technologies;

- iii) To develop a suitable model to represent technology utilisation among broiler producers;
- iv) To suggest improvements for better technology utilisation among broiler producers.

1.5 Research questions

Eisenhardt (1989), as cited in Christenson (2007), suggested that *‘the investigators should formulate a research problem and possibly specify some potentially important variables, with reference to extant literature. However, they should avoid thinking about specific relationships between variables and theories as much as possible, especially at the outset of the process’*. Therefore, to achieve the research, aim, and objectives, the following research questions were developed:

- i) What is the role of technology utilisation in agriculture?
- ii) What are the issues and challenges of agricultural technology utilisation in the broiler industry?
- iii) What are the important requirements to consider for a model development to ensure successful broiler production?
- iv) What are the improvements for better technology utilisation among broiler producers?

1.6 Research scope and limitation

The focus of this research is to understand technology utilisation by Malaysian broiler players in sustaining Malaysia’s food production. Broiler players, in this research context, are broiler producers who are involved in broiler production in Malaysia.

This research focused on the exploration of the issues and challenges of technology utilisation relating to broiler production and implementation faced by Malaysian broiler players. The lack of sufficient theoretical understanding of technology utilisation in broiler production and its implementation emphasised the requirement for a more in-depth approach. This is achieved through the exploration of broiler production from the perspective of those involved.

The research intends to investigate the issues surrounding the successful and unsatisfactory implementation of broiler production solely from Malaysian broiler producers' perspective, and to develop a theory to the reasons for those issues. It is also intended that the results will assist various parties involved in the broiler industry to understand what they need to do to address those issues.

1.7 Significance of the research

There is increasing research on agriculture in Malaysia. However, to date, there is less research on technology utilisation in agriculture conducted in Malaysia in the context of the broiler industry, which also takes into account the stability dimensions of food production. An appropriate relationship model is needed to evaluate the current position of broiler production and to identify opportunities to move towards strengthening broiler production in Malaysia.

A small number of previous studies investigating technology utilisation in broiler production in Malaysia is the primary motivation for this research. Most agricultural studies focused on rice production in Malaysia because rice is the staple food for all Malaysians. The current research plans to evaluate the suitable or appropriate technology practices to be implemented in CH systems to ensure sustainability, availability, utilisation, and stability of