RICE BLOCKCHAIN TECHNOLOGY AS A NEW STRATEGY IN ENSURING FOOD SECURITY IN MALAYSIA

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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 a Bachelor of Technology Management and Technopreneurship with Honours (Technopreneueship)

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This Report Submitted in Partial Fulfilment of the Requirement for the Award of Bachelor of Technopreneurship with Honour

Faculty Technology Management and Technopreneurship

Universiti Teknikal Malaysia Melaka (UTeM)

DECEMBER 2019

DECLARATION

"I admit this report is the result of my own work except the summaries and excerpts of which I have listed all the sources"

Signature :…….

Name : SERINNAH VAN BUERLE

Date :…….

DEDICATION

I dedicate this research to my loving family, Gina, Rachael and Isaac, who have supported and encouraged me throughout the period of this project. I would also like to dedicate the successful completion of this research to my supervisor, Dr. Fam Soo Fen, who has gone above and beyond to teach and guide me at every step. A special thank you to my panel, Dr. Yusri bin Arshad for his insight and input that has much improved this research.

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ACKNOWLEDGEMENT

I would like to express my appreciation for the support and guidance provided by my supervisor, Dr Fam Soo Fen. Thank you for always being patient and supportive as I faced the many challenges of carrying out this research project. It was a privilege to be under your supervision and garner new skills in research.

Thank you to my panel, Dr Yusri bin Arshad, who has been very helpful in providing constructive comments and details to better present my research. I appreciate the time taken to thoroughly review my thesis. I would also like to extend my appreciation to the Faculty of Technology Management and Technopreneurship (FPTT) of Universiti Teknikal Malaysia Melaka (UTeM) in providing the facilities and resources that has greatly assisted me in carrying out this research.

Special acknowledgement for a few individuals who have encouraged and assisted me during my research. Firstly, thank you to Caleb Choong for being supportive and insightful when I experienced road blocks. Lim Kai Syn, thank you for your reassurance in times when I felt unable to carry on. Thank you also to Melisa Chong and Liang Wei who have gone the extra mile in helping me during my data collection period. Finally, a big thank you to my classmate, Ong Kim Soon, who has been with me at every step of the way.

ABSTRACT

The staple food of Malaysia is rice and it represents the main dish or ingredient is almost every meal. As the population of Malaysia grows at a positive rate, the demand for rice also increases. However, over the past years, local production has only been able to supply about 60% to 70% of the demand. The remaining is imported from neighbouring countries such as Thainland, Myanmar and Vietnam. While the Malaysian population grows and local production remains constant, the gap between demand and supply continues to grow. Malaysia's inability to feed local consumption is displayed by the self-sufficiency level (SSL). The rice industry is faced with several challenges including poor management. In order to improve the SSL, Malaysia must look to innovate methods to better monitor and respond in the industry. Previous research has highlighted that the integration of the various elements within the supply chain will result in a more competitive, efficient and sustainable rice industry. This study brings attention to the role of Blockchain Technology in improving the Malaysia rice supply chain. Interviews are carried out with industry players and government officers to understand the current rice supply chain and the interactions of each member. This will then lead to the designing of the blocks in the digital ledger and the pioneer framework of the Malaysia rice Blockchain supply chain. The framework represents the foundation for future Blockchain Technology research and application in the local rice industry.

ABSTRAK

Makanan ruji di Malaysia adalah nasi dan merupakan hidangan atau ramuan utama dalam hamper setiap hidangan. Apabila populasi Malaysia semakin meningkat pada kadar yang positif, permintaan untuk nasi juga akan meningkat. Walau bagaimanapun, sepanjang tahun-tahun yang lalu, pengeluaran tempatan hanya dapat membekalkan kira-kira 60& hingga 70% daripada perminttan seluruh negara. Selainnya diimport dari negara-negara jiran seperti Thailan, Myanmar dan Vietnam. Populasi Malaysia semakin meningkat tetapi peneluaran tempatan masih berterusan dan menyebabkan jurang antara permintaan dengan pembekalan semakin berkembang. Ketidakupayaan Malaysia untuk membekalkan nasi yang seimbang dengan permintaan tempatan ditunjukkan oleh kadar dalam self-sufficiency level *(SSL) negara. Indsutri beras dihadapi oleh beberapa cabaran termasuk pengurusan yang lemah. Bagi meningkatkan SSL, Malaysia harus membawa pandangan kepada kaedah berinovasi untuk memantau dan bertindak balas lebih baik dalam industri. Kajian terdahulu telah menekankan bahawa integrase elemen-elemen dalm rantaian bekalan dapat menghasilkan industri beras yang lebih kompetitif, cekap dan mampan. Kajian ini membawa perhatian kepada peranan* Blockchain Technology *dalam meningkatkan rantaian bekalan beras Malaysia. Temubual dijalankan dengan pemain industry dan pegawai kerajaan untuk memahami rantaian bekalan beras semasa dan interaksi setiap ahli. Ini kemudian akan membawa kepada rekabentuk blok dalam lejar digital dan rangka perintis rantaian bekalan beras Malaysia bedasarkan* Blockchain Technology. *Rangka kerja ini merupakan asas untuk penyelidikan dan aplikasi* Blockchain Technology *dalam industri tempatan pada masa depan.*

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ABBREVIATIONS

ABBREVIATIONS	MEANING
SSL	Self-sufficiency Level
BCT	Blockchain Technology
DoA	Department of Agriculture
IADA	Integrated Agricultural Development Area
PKI	Public Key Infrastructure

CHAPTER 1

INTRODUCTION

1.1 Introduction

This chapter will give an overview of Blockchain Technology (BCT) and how it has emerged to be one of the most disruptive technologies. To date there are three revolutions of the Blockchain Technology according to its various applications. The application and benefits of this technology in supply chains are also discussed.

1.2 Background of Study

Rice represents the staple food of people in Malaysia. Although local consumption has diversified to include more wheat products, rice is still an essential component of the Malaysians' diet (Warr et al., 2008). That being so, it is important for the government to safeguard the supply of rice to accommodate current and future consumptions of the nation.

According to Rajamoorthy and Munusamy (2015), the computed production trends indicate that Malaysia will not be able to supply sufficient rice to meet future demands. Malaysia's open economy takes advantage of the rice import activities to compensate for demand not met. However, it is not ideal for Malaysia to continue depending on external sources to meet local demand for a staple food.

A review by Ahmed and Siwar (2013) noted that the biggest challenge for food security in Malaysia lies in the ability to increase self-sufficiency levels of agricultural products including rice. Improving self-sufficiency levels is important to reduce the nation's dependency on imported produce.

An estimated 10%-35% of the total local demand is imported from neighbouring countries such as Myanmar, Thailand, Vietnam, Pakistan and India (Chung and Tan, 2015). While production levels have not grown proportionately to population growth, Malaysia is labelled as an unproductive rice producer (Ariff and Lopez, 2007).

Therefore, it is a rising need to identify and delve into innovative methods to improve self-sufficiency levels (SSL). According to Wong et al. (2010), there is a need for the rice industry to link the various elements in the supply chain as an effort to develop a more competitive, efficient and sustainable rice supply chain in Malaysia.

1.3 Problem Statement

The 11th Malaysia Plan (EMP) (2015) represents part of a systematic plan for national development that consists of macroeconomic targets and strategic thrusts. Strategic thrust 6 is re-engineering economic growth for greater prosperity and one of the main strategies include modernising agriculture. Agriculture has contributed significantly to the nation's economy over the years as shown in Figure 1 and it is important for the sector to keep up with technology advancements that will enhance operations. In 2017, the government of Malaysia highlighted that modernising the industry would bring several benefits including improved nutrition and better food security (Kaur, 2017). This is vital as the population of Malaysia is estimated to increase to 34.14 million by 2022 from the 32.57 million in 2018 (Department of Statistics, 2018; Statista, 2019).

In line with the EMP, The Malaysia Sustainable Development Goals 2017 highlights 17 critical aspects of the nation that will guide and lead to a sustainable future. Each aspect represents a goal to be achieved in order to attain Malaysia's vision of becoming a developed nation (The Government of Malaysia, 2017). Goal 2 is to end hunger, achieve food security and improved nutrition, and promote sustainable agriculture. The staple food of Malaysian people is rice and thus it is an important source to maintain. According to the report of OECD-FAO Agricultural Outlook 2018, the gap between Malaysia's production and consumption levels of rice are expected to widen substantially. In the year 2016, the consumption of rice in Malaysia was 2.7m MT and OECD projections predict rising of the trend as the national population grows.

In an effort to increase food security, the Malaysian government seeks to improve self-sufficiency levels of rice from 70% in 2018 to 80% by 2023 ("Govt targets in increase self-sufficiency level", 2018). This is vital as the population of Malaysia is estimated to increase to 34.14 million by 2022 from the 32.57 million in 2018 (Department of Statistics, 2018).

A report released by the Khazanah Research Institute highlighted a few issues in the Malaysia rice industry such as high cost of production, slow release of new paddy varieties and poor farm management practices (Omar, Shaharudin & Tumin, 2019). Research has shown that adoption and use of technology such as for tracking to manage information and improve visibility across a supply chain allows firms to reduce transaction costs and increase traceability (Basole & Nowak, 2018; Lee et al, 2008). One of the most talked about technology to emerge and impact supply chains is Blockchain Technology that was introduced by Nakamoto (2008).

To date, there has only been general discussion on the benefits of Blockchain technology to supply chains in Malaysia. Reports and researches on the use of Blockchain in the context of supply chains in Malaysia is scarce (Tieman & Darun, 2017, Thiruchelvam et al, 2018; Tan, Xuan & Cottrill, 2018). Therefore, this research aims to identify the challenges and information required across the supply chain that will lead to develop a proper rice Blockchain-based current supply chain design. Ultimately, BCT has the potential to increase transparency and traceability across the rice supply chain in Malaysia that will also increase trust of stakeholders.

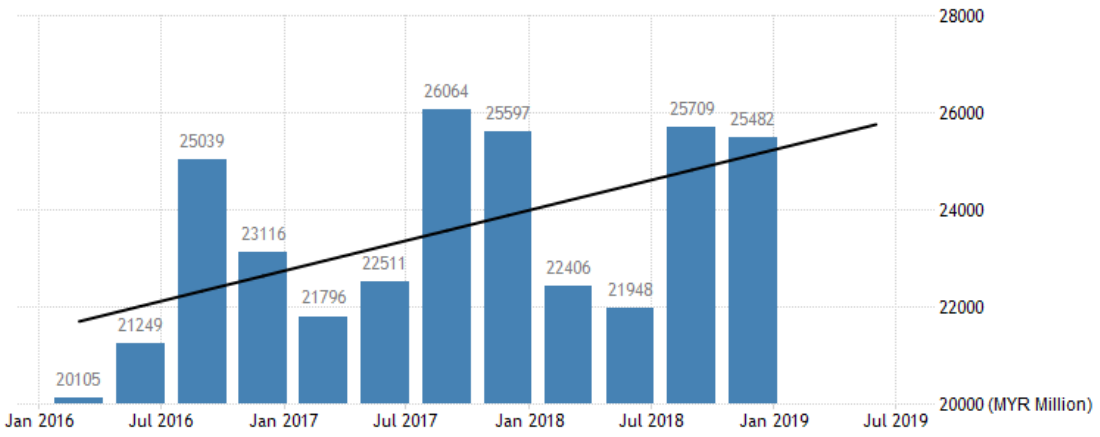

Figure 1.1: Malaysia Growth Domestic Product (GDP) from Agriculture (2016-2019)

(Source: Department of Statistics Malaysia)

1.4 Research Questions

The research questions are the guidelines to the study to which the researcher will investigate. The research questions for this study are as follows:

1. What are the current rice supply chain challenges in Malaysia?

2. What information is needed in creating the Blockchain Technology ledgers to overcome the current rice supply chain challenges in Malaysia?

3. How to visualise the information?

1.5 Research Objectives

The research objectives are the specific goals this research aims to achieve. The objectives directly address each of the research questions previously stated. The research objectives of this are as follows:

1. To identify the current rice supply chain challenges in Malaysia.

2. To determine the information needed in creating the Blockchain Technology ledgers to overcome the current rice supply chain challenges in Malaysia.

3. To visualise the information of the Malaysia rice Blockchain Technology model.

1.6 Significance of Study

This research is aimed at investigating the current state of the rice industry in Malaysia and to design a rice Blockchain supply chain conceptual model. As Malaysia works towards achieving the food security goals set in the Eleventh Malaysia Plan and the Sustainable Development Goals, it is important to look into the rice industry as it represents the staple food of the nation. This research aims to design a Blockchain supply chain for the rice industry in an effort to increase transparency and traceability, and decrease costs that will improve the food security of rice in Malaysia.

1.7 Scope and Limitations

This study focuses specifically on the rice industry of Malaysia as it adapts to the technology brought by Industry 4.0. The scope of this study will be aimed primarily to visualise the information of the Malaysia rice Blockchain technology model. The conceptual model of this technology is expected to enhance the rice supply chain processes that will ultimately improve food security of rice. The limitation of this study is that literature on rice Blockchain technology is still scarce.

1.8 Structure of Thesis

Table 1.1: Structure of Thesis

Chapter	Brief Description
Chapter 1 – Introduction	This chapter will provide a brief discussion the background of this research, the problem statement, research questions and objectives, significance of the study, scope and limitations.
Chapter 2 – Literature Review	This chapter will review previous and related studies to this research. Concepts and basic knowledge are reviewed to form the basis of this research.
Chapter 3 – Methodology	This chapter will describe and explain the methods selected to carry out the research.
Chapter 4 – Data Analysis	This chapter will analyse the data as collected through the selected method in Chapter 3. Results from the data will be discussed.
Chapter 5 – Discussion and Conclusion	This chapter will provide a summary of the overall analysis and come to a conclusion on the findings of this research. The findings will reflect the research questions and objectives of this study. Recommendation for future research will be given.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter will discuss preliminary findings from previous related studies and academic sources such as articles, journals, books and trusted online sources. The rice industry of Malaysia and the challenges it faces are discussed. The importance and discussion on food security is also presented. Following that, an understanding of Blockchain Technology and its applications in supply chains are also discussed.

2.2 Rice Industry in Malaysia

Rice is an essential part of the daily diet for consumers in the Southeast Asian countries and that includes Malaysia. It also represents an important area to the nation's economy and it has been produced and consumed for decades. The agriculture sector was recorded to have an annual growth rate of 11.1 per cent to RM 91.2 billion from the RM 73.9 billion in 2015 (Department of Statistics Malaysia, 2019). Malaysia had set a target of 70% SSL as in the new Agro-Food Policy (2011-2020).

2.2.1 Production and Consumption

In 2016 the population of Malaysia was 31.8 million (Department of Statistics Malaysia, 2016) and rose to 32.6 million in 2018 (Department of Statistics, 2018). In the year of 2016, the milled rice production was 1.82 million MT in Malaysia with an average yield of 4.03 t/ha, and total consumption was 2.4 million MT for the total 31.8 million population (IRRI, 2017 & Department of Agriculture, 2017). It was reported that of the total rice consumed, 67% was produced by local farmers while the remaining 33% was imported mainly from Thailand, Vietnam and Pakistan (Omar, Shaharudin & Tumin, 2019).

Statistics show that the production of milled rice was at a constant 1.82 million MT for the past three years (2016-2018) despite the growing population (Indexmundi.com, 2019). According to the report of OECD-FAO Agricultural Outlook 2018, the gap between Malaysia's production and consumption levels of rice are expected to widen

substantially. As the gap widens, Malaysia's dependency on rice imports will increase to fulfil market demands.

A study comparing the population growth rate against the local rice production rate estimated a shortage of rice in the market by 2030 as demand for rice in the future will significantly increase (Rajamoorthy & Munusamy, 2015). The research stresses that if Malaysia does not improve its production of rice, the nation is expected to face a shortage of supply and will be dependent on other countries to meet demands.

2.2.2 Imports

Malaysia is a net importer of rice and is one of many countries that import a significant quantity of rice each year (Muthayya et al, 2014). In the years 2016 and 2017, Malaysia imported 900 000 MT of rice to fulfil the remaining 30% of demand not covered by local production (IRRI, 2018; "The Government is ready to import more rice", 2016).

In 2018, the Ministry of Agriculture and Agro-based Industries released a statement that the government intends to open up 30% of the rice monopoly held by Padiberas Nasional Bhd (Bernas) to other industrial players ("30 percent of Bernas monopoly", 2019). The ministry acknowledged that control is needed in breaking the monopoly as it involves food safety.