UNIVERSITI PUTRA MALAYSIA

EFFICIENCY OF PEPPER FARMS IN SARAWAK

ANITA ROSLI

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EFFICIENCY OF PEPPER FARMS IN SARAWAK

By

ANITA BINTI ROSLI

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirements for the Degree of Doctor of Philosophy.

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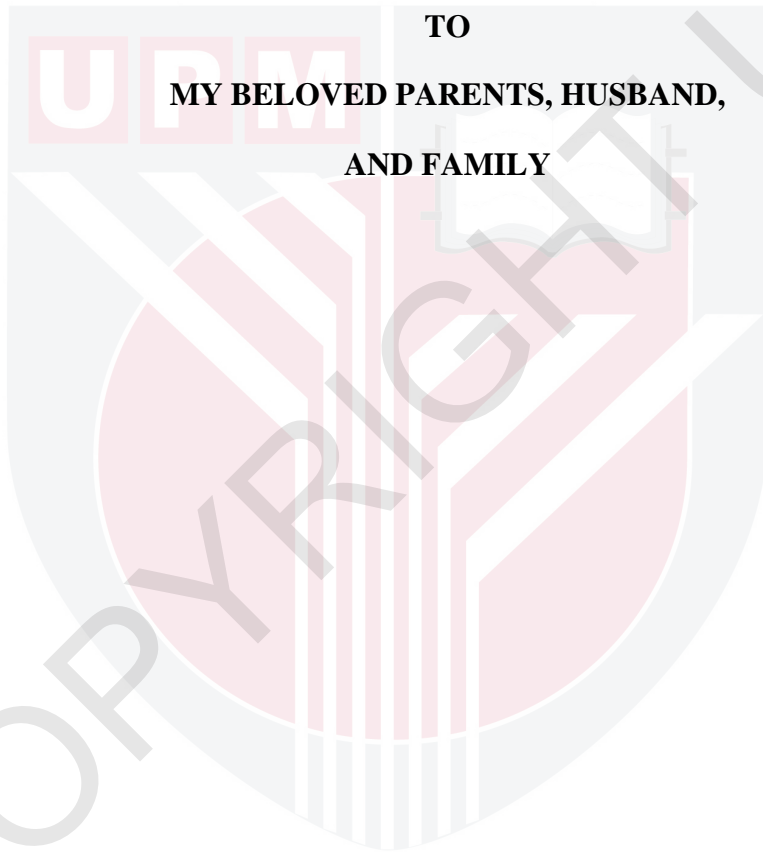
DEDICATED

TO

MY BELOVED PARENTS, HUSBAND,

AND FAMILY

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of
the requirements for the degree of Doctor of Philosophy

EFFICIENCY OF PEPPER FARMS IN SARAWAK

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July 2013

Chairman   : Professor Khalid Abdul Rahim, PhD

Institute   : Agricultural and Food Policy Studies

Pepper is one of the important crops and source of income for 67,000 families in the
interior areas of Sarawak. However, pepper farmers faced a few major problems such as
the increasing cost of inputs, escalating management cost of pest and disease attacks,
and fluctuating pepper price at international market (DOA, 2012). Pepper farming
requires a proper management of resources and farming operations to ascertain high
yield at minimum cost and increase farm profit. The previous studies about efficiency in
pepper production in Sarawak by Noorzakiah, Alias, and Sazali (1993), Mohd, Alias,
and Ruhana (1993), and Hamid and Mansor (1997) found that pepper farms in Sarawak
were inefficiently in resource use.

However, there are various factors influence relative performance and efficiency level
among pepper farms such as market factors, geographical location, socioeconomic
background, farming practices, and government intervention. Thus, a single decision
can easily make a difference between efficiency and inefficiency of pepper farms.

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Therefore, this study is carried out to analyze the performance of pepper farms in Sarawak by estimating the level of efficiency of pepper farms.

A sample of 678 pepper farmers was selected for this study through field survey that was conducted from August to December 2009. Stochastic Frontier Analysis (SFA) and Data Development Analysis (DEA) method were applied to estimate technical, allocative, economic, and cost efficiency of pepper farms. The inefficiency model and Tobit model were used to investigate the determinants of efficiency in pepper farming. The factors of the adoption of farming technology in pepper farming among farms are estimated using Logit model.

The mean technical efficiency, allocative efficiency, and economic efficiency were estimated to be 0.518, 0.496, and 0.258 respectively by using SFA method. From DEA model, the mean technical efficiency under constant returns to scale (CRS) and variable returns to scale (VRS) were 0.567 and 0.661 respectively while the mean allocative efficiency and cost efficiency were estimated to be 0.585 and 0.438 respectively. The mean efficiency scores from DEA model were higher than SFA model, these results indicate that DEA model fitted tightly to the data set compared than SFA.

Pepper farms are inefficient since the mean of technical, allocative, economic, and cost efficiency of pepper farms are low. Farmers are technically inefficient in input utilization and inefficient in input allocation hence they are not maximizing the output and not minimizing cost. The inefficiencies among pepper farms are due to improper farm management and misallocation of inputs. Besides, inefficiencies among farms also

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due to the age of farmers where majority of sample farmers are consist of older farmers. However, the efficiency in farm management is positively and significantly influenced by education level, the frequency of contacts with extension agents per year, being member of farmer's organization, being full-time pepper farmers, and attending farming courses and study visits. Therefore, it is imperative that farmers should improve their farm performance and efficiency level through effective of agronomic education and extension services.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk Ijazah Doktor Falsafah

KECEKAPAN KEBUN-KEBUN LADA DI SARAWAK

Oleh

ANITA BINTI ROSLI

Julai 2013

Pengerusi   **: Professor Khalid Abdul Rahim, PhD**

Institut   **: Kajian Dasar Pertanian dan Makanan**

Lada ialah salah satu tanaman yang penting dan sumber pendapatan bagi 67,000 keluarga di kawasan pedalaman Sarawak. Walau bagaimanapun, petani lada menghadapi beberapa masalah utama seperti peningkatan kos input, peningkatkan kos pengurusan bagi serangan perosak dan penyakit, dan harga lada yang naik turun di pasaran antarabangsa (Jabatan Pertanian, 2012). Pertanian lada memerlukan pengurusan sumber-sumber dan operasi pertanian yang teliti untuk memperolehi hasil yang tinggi pada kos yang minimum dan keuntungan yang tinggi. Kajian terdahulu mengenai kecekapan dalam pengeluaran lada di Sarawak oleh Noorzakiah, Alias, dan Sazali (1993), Mohd, Alias, dan Ruhama (1993), dan Hamid dan Mansor (1997) mendapati bahawa kebun-kebun lada di Sarawak adalah tidak cekap dalam penggunaan sumber.

Walau bagaimanapun, terdapat pelbagai faktor yang mempengaruhi relatif prestasi dan kecekapan kebun-kebun lada seperti faktor pasaran, lokasi geografi, latar belakang sosio-ekonomi, amalan pertanian, dan campur tangan kerajaan. Demikian, satu

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keputusan boleh membuat membezakan antara kecekapan dan ketidakcekapan kebun. Dengan itu, kajian ini dijalankan untuk menganalisis prestasi kebun lada di Sarawak dengan menganggarkan tahap kecekapan kebun lada.

Satu sampel sebanyak 678 petani lada telah dipilih untuk kajian ini melalui kajian lapangan yang telah dijalankan daripada bulan Ogos hingga Disember 2009. Kaedah Analisa Sempadan Stokastik (SFA) dan Analisis Pembangunan Data (DEA) telah digunakan untuk menganggarkan kecekapan teknikal, pengagihan, ekonomi, dan kos kebun-kebun lada. Model ketidakcekapan dan model Tobit telah digunakan untuk mengkaji penentu kecekapan dalam penanaman lada. Model Logit digunakan untuk mengkaji faktor-faktor adaptasi teknologi pertanian dalam penanaman lada kebun-kebun lada.

Min kecekapan teknikal, pengagihan, ekonomi masing-masing adalah 0.518, 0.496 dan 0.258 dengan menggunakan kaedah SFA. Untuk model DEA, purata kecekapan teknikal di bawah andaian pulangan kepada skala (CRS) dan pulangan berubah kepada skala (VRS) adalah 0.567 dan 0.661, manakala purata kecekapan pengagihan kos masing-masing dianggarkan 0.585 dan 0.438. Min skor kecekapan daripada model DEA adalah lebih tinggi daripada model SFA, keputusan ini menunjukkan bahawa model DEA lebih bersesuaian dengan set data berbanding dengan SFA.

Kebun-kebun lada tidak cekap lantaran min kecekapan teknikal, pengagihan, ekonomi, dan kos kebun-kebun lada adalah rendah. Petani adalah tidak cekap dari segi teknikal dan tidak cekap dalam pengagihan input maka mereka tidak memaksimumkan output

dan tidak menjimatkan kos. Ketidakcekapan kebun-kebun lada adalah disebabkan oleh pengurusan kebun yang tidak betul dan kesilapan pengagihan input-input. Selain itu, ketidakcekapan kebun-kebun juga disebabkan oleh usia petani-petani kerana majoriti petani-petani adalah terdiri daripada golongan tua. Walau bagaimanapun, kecekapan pengurusan kebun adalah secara positif dan signifikasi dipengaruhi oleh tahap pendidikan, kekerapan berhubungan dengan ejen pengembangan, ahli organisasi petani, petani lada sepenuh masa, menghadiri kursus-kursus pertanian dan lawatan sambil belajar. Oleh kerana itu, ia adalah penting untuk petani meningkatkan pencapaian dan kecekapan kebun melalui pendidikan agronomi dan perkhidmatan-perkhidmatan pengembangan yang berkesan.

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This thesis submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Doctor of Philosophy. The members of the Supervisory Committee are as follows:

Khalid Abdul Rahim, PhD
Professor
Agricultural and Food Policy Studies Institute
Universiti Putra Malaysia
(Chairman)

Alias Radam, PhD
Associate Professor
Faculty of Economics and Management
Universiti Putra Malaysia
(Member)

Amin Mahir Abdullah, PhD
Associate Professor
Faculty of Agriculture
Universiti Putra Malaysia
 (Member)

_____
BUJANG BIN KIM HUAT, PhD
Professor and Dean
School of Graduate Studies
Universiti Putra Malaysia

Date:

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DECLARATION

I declare that the thesis is on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Putra Malaysia or other institutions.

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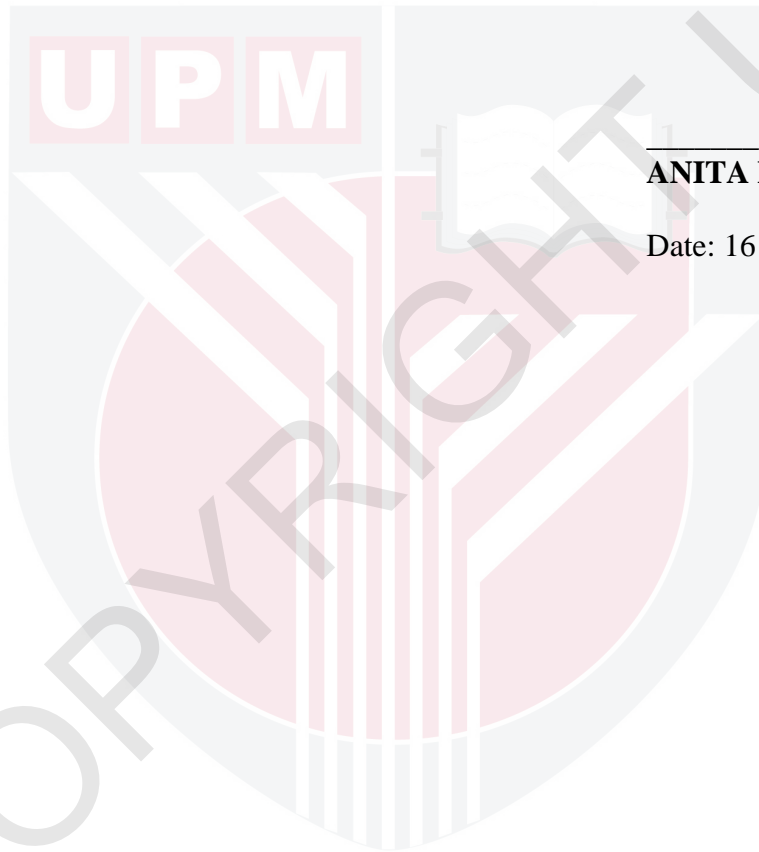
ANITA BINTI ROSLI

Date: 16 July 2013

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LIST OF ABBREVIATIONS

AFO	Area Farmers' Organization
AE	Allocative Efficiency
AP	Average Product
ARC	Agriculture Research Centre
ASTA	American Spice Trade
BP	Bridge Press
CE	Cost Efficiency
COLS	Corrected Ordinary Least square
CRS	Constant Returns to Scale
DEA	Data Envelopment Analysis
DMU	Decision Making Unit
DOA	Department of Agriculture
DRS	Decreasing Returns to Scale
EE	Economic Efficiency
Eurep GAP	European Good Agricultural Practices
FAQ	Fair Average Quality
FDA	Food and Drug Administration
GMP	Good Manufacturing Practices
HACCP	Hazard Analysis Critical Control Point
IPC	International Pepper Community
IRS	Increasing Returns to Scale
ISBPT	Improved Shea Butter Processing Technology

KTPL	Pepper Production Technology Course
LFA	Less-Favoured Areas
LP	Linear Programming
MP	Marginal Product
MPB	Malaysian Pepper Board
MPIC	Ministry of Plantation Industries and Commodities
MPP	Marginal Physical Product
NAP3	Third National Agriculture Policy
NIRS	Non-Increasing Returns to scale
NES	Nucleus Estate and Smallholder
NPAR	Nonparametric Frontier
OA	Organic Agriculture
OLS	Ordinary Least Square
PENlada	Training and Pepper Development Centre
PMB	Pepper Marketing Board
RISDA	Rubber Industry Smallholders Development Authority
RTS	Returns to Scale
R&D	Research and Development
S.D	Standard Deviation
SFA	Stochastic Frontier Analysis
SPF	Stochastic Parametric Frontier
SFO	State Farmers' Organization
SPIC	Sarawak Produces Industries Corporation
SPSS	Statistical Package for the Social Sciences

TE	Technical Efficiency
TEcrs	Technical Efficiency under Constant Returns to Scale
TEvrs	Technical Efficiency under Variable Returns to Scale
TWT	Total Weighted Tree
UN-ESCAP	United Nations Economic and Social Commission for Asia and the Pacific
USA	United States of America
USSR	Union of Soviet Socialist Republics
VMP	Value Marginal Product

CHAPTER 1

INTRODUCTION

1.1   Overview

The agricultural sector has played a crucial role and contributed significantly to the growth and development of the Malaysian economy since the country's independence in 1957. Pepper crop is one of the important commodities produced by the country besides palm oil, rubber, timber, cocoa, and tobacco. Products from these commodities are significant components of the Malaysian economy and exports of these commodities and commodity-based products registered an increase of 24.27 percent to RM113.3 billion in 2010 from RM91.2 billion in 2009 (Statistic of Commodities, 2010).Until September 2012, pepper production was the third largest represented by 24,700t after palm oil (13,175,275t) and rubber (678,719t) (MPIC statistic, 2013).The pepper industry in Malaysia is export-oriented since about 90% of pepper production is for export and it also contributing to the national income. In 2012, pepper products (black, white, and green) contributed RM174.99 million (0.18%) to export earnings from commodities (MPIC statistic, 2013). Until 2011, Malaysia was the fifth largest pepper producer in the world while Vietnam was the largest pepper producer (100,000t) followed by India (48,000t), Indonesia (37,000t), Brazil (35,000t), Malaysia (25,672t), Republic of China (23,300t), and other countries (Figure 1.1).
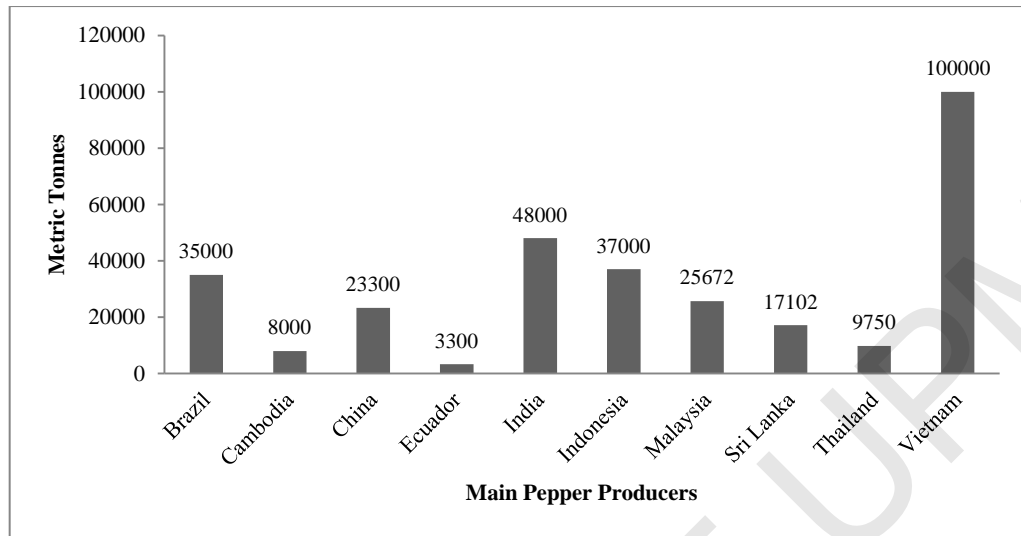
Figure 1.1: World Pepper Production 2011
(Source: International Pepper Community (IPC), 2012)

Most of Malaysian pepper (90%) is produced at Sarawak and the remainder comes from Johor, Malacca, and Sabah and as a result the commercial name for Malaysian-grown pepper is Sarawak Pepper in the world marketplace. Pepper crop is cultivated in small farms averaging 0.2 ha in Sarawak and it is also successfully grown on a large scale (7ha – 13ha) by individuals and private companies in the state of Johor and Malacca. The tropical climate of Malaysia, especially Sarawak is ideal for pepper cultivation and pepper is one of the important agricultural commodities for Sarawak other than palm oil and sago. In 2010, agricultural products were the third contributor of principal exports of Sarawak with export value of RM8,093,177 while other products such as petroleum, timber, and other goods contributed RM54,893,684, RM2,723,703, and RM10,561,237 respectively (DOA, 2013). Meanwhile, in 2012 the average monthly net income was RM4239 per hectare (MPIC statistic, 2013) implying that the pepper crop providing higher income to farmers. High production and productivity at farm level make local

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pepper industry competitive. Therefore, the development of pepper production at farm level should be seriously considered by the industry.

1.2   Problem Statement

Pepper is one of the important crops to the economy of Sarawak and it is also one of an important source of income for 67,000 rural families in the interior areas of Sarawak.The relative lack of market access for other agricultural produce makes pepper the most suitable crop for these areas and pepper is considered as an important political cash crop for rural families in Sarawak. However, pepper farmers faced a few major problems such as the increasing cost of inputs (fertilizer, pesticide, labour), escalating cost for managing pest and disease attacks, and fluctuating pepper price at international market (DOA, 2012). Pepper crop is a labour and capital intensive cash crop. It requires a proper management of resources and all farming operations to ascertain high yield at minimum cost, and as well as increase farm profit.

Production and productivity at farm level is influenced by the efficiency in farm management where it is related with the efficiency of utilization of resources such as agricultural inputs, capital, labour, and land. Efficiency in farm management will achieve when the farmer is able to utilize the available resources at optimum level to achieve high production and productivity at minimum cost as well as gain high profit. However, the previous studies about efficiency in pepper production in Sarawak by Noorzakiah, Alias, and Sazali (1993), Mohd, Alias, and Ruhana (1993), and Hamid and Mansor (1997) found that pepper farms were inefficiently in resource use. Therefore, the

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effective of farming education and extension services are needed to improve farm performance and efficiency level.

There are various factors influence farm performance and efficiency level among pepper farms.The scattered pepper farms in the hilly terrain of the interior and lack of basic infrastructure and amenities are challenges faced by pepper farmers in Sarawak. Farmers also react to specific local conditions including change in input and pepper prices by attempting to choose the best production practices that maximize output and minimize costs. Instead of market factors, the farm performance and efficiency level are different because farmers as a farm manager or decision making unit (DMU) come from different location and socioeconomic background. Moreover, personal preference over inputs contributes to the variation in farm performance where the combinations of inputs use make a different in output maximization among farms. Besides, Government's intervention in the form of agricultural extension is also affecting farmer's behavior can influence farmer's decision in pepper farming and as well as the efficiency of input utilization. The main reason the government participated in the industry was to provide fair returns to farmers and improve farm performance. Majority of pepper farmers consist of the elderly and less educated. However, through extension services, farmers were learned about technology in pepper farming that can help them to maximize pepper yield even though they had learned about pepper farming practices from their experience. Therefore, all these factors influencing farmer's decision on farming operation where a single decision can easily make a difference between efficiency and inefficiency among farms.

This study is carried out to examine the performance of pepper farms in Sarawak in recent years by estimating the level of efficiency among farms. It will identify the sources where improvements of current policy can be made to help the pepper farmers to increase production level, minimize production cost, and as well as increase profit. This study is expected to provide useful information relevant for policy decision making.

1.6   Objectives of the Study

The main objective of this study is to evaluate the performance of pepper farms in Sarawak. The specific objectives are

a)   To estimate farms technical, allocative, economic, and cost efficiency

b)   To analyze the determinants of inefficiency of pepper farms

c)   To identify the factors influencing technology adoption in pepper farming

1. 7   Significance of the study

A study on efficiency in pepper farms gives the public a better understanding on the current situation of pepper cultivation practices in the state of Sarawak. The focus of this study is to investigate the performance of pepper smallholders by estimating the technical, allocative and economic efficiency. In addition, this study will also investigate the influence of socioeconomic and farm-specific factors on the efficiency in pepper farming operation. Thus, this study will identify the efficiency or inefficiency factors among pepper farms in Sarawak. It is expected that the findings of the study will provide directions for the government and related agencies to formulate effective actions to improve the efficiencies of pepper production in Malaysia. The improvement of pepper farming efficiency at upstream level will help farmers to boost production and gain more

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profit which will improve their livelihood. Proposed government intervention in pepper industry includes agriculture subsidy schemes, extension services, and improved marketing activities and these proposals will determine the impact of the current policy on the current situation in pepper production in Sarawak.

1. 8   Organization of the Study

This study contains six chapters including the introduction. Chapter 2 reviews the background of pepper industry in Malaysia from upstream to downstream level. Chapter 3 discusses the concepts and theories of production, efficiency, efficiency measurement methods and including a review of some literature on efficiency studies in pepper production and other perennial crops by using SFA and DEA. Chapter 4 explains the research methodology in terms of data collection, variables selection, and research model used in this study. Then, Chapter 5 discusses the results and findings of technical, allocative, and economic efficiency estimation and the determinants of efficiency among pepper farms. Finally, Chapter 6 summarizes the findings of this study and suggests the relevant policy to solve the performance problems based on the sample obtained from the pepper farms. Moreover, this chapter also explains the limitation of this study and suggests further research for efficiency study of pepper farms in Malaysia.

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BIODATA OF STUDENT

The student was born on September 08, 1983 in Sibu, Sarawak. She attended primary school at Sekolah Rendah Kebangsaan (SRK) Batu 10 Kem Rascom, Sibu. She attended secondary school at Sekolah Menengah Kebangsaan (SMK) Rosli Dhoby and passed Upper Six in 2002.

She joined Universiti Malaysia Sarawak (UNIMAS) and completed Bachelor of Social Science (Honours) in Development, Planning, and Management in 2006. She completed Masters in Economic Development in December 2008 from Universiti Putra Malaysia (UPM). She joined at Institute of Agricultural and Food Policy Studies at UPM in January 2009 to undertake PhD study in Agricultural Policy Development. The Graduate School of Studies, UPM provided financial support under Grant Research Financial to the student for undertaking the study.

The student joined as Research Assistant, in the Project titled "An Economic Study of Pepper Production in Malaysia: Challenges and Prospects of the Industry" under the Memorandum of Understanding (MOU) between the Ministry of Plantation Industries and Commodities (MPIC) with UPM, the Malaysian Pepper Board (MPB) proposes and UPM carries out the study on the economics of pepper industry in Malaysia from January 2009 to January 2011.

LIST OF PUBLICATIONS

1. Article Journal

i. Anita, R., Alias, R., and Khalid, A.R. (2013). Technology Adoption in Pepper Farming: A Case Study in Sarawak. *The International Journal of Social Science.* 11(1): 16-22.ISSN 2305-4557.

ii. Anita, R., Alias, R., and Khalid, A.R. (2013). Technical Efficiency of Pepper Farms in Sarawak, Malaysia: An Application of Data Envelopment Analysis. *International Journal of Business and Social Science,* 7(4):227-234.

iii. Anita, R., Khalid, A.R, Alias. R., and Amin, M. A. (2013). Determinants of Cost Efficiency of Smallholders Pepper in Sarawak, Malaysia. *Asian Journal of Social Sciences and Humanities.* 2(3):78-86. ISSN 2186-8492.

2. Proceeding

i. Khalid, A.R., Anita, R., and Audrey, L. (2011). Benchmarking Entrepreneurship for Rural Pepper Farmers in Sarawak. *Proceedings of the 1st International Conference on Rural Development and Entrepreneurship, Kuching, Sarawak*, pp. 463-475.

ii. Anita, R., Alias, R., and Khalid, A.R. (2012). Technical Efficiency Among Smallholder Pepper in Sarawak. *Proceeding of 'Seminar Hasil Penyelidikan Kementerian Pengajian Tinggi. Jilid I Sains Sosial dan Kemanusian*, pp.27-34'.

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i.   Khalid, A.R., Anita, R., and Audrey, L. (2012). Inculcation of Entrepreneurship among Rural Farmers in Sarawak. OPTIONS, Vol. 17(1), 11-17. Institute of Agricultural and Food Policy Studies, Universiti Putra Malaysia.

5. Project Report

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