

UNIVERSITI PUTRA MALAYSIA

VEGETABLE PRODUCER AND WHOLESALER ATTITUDES TOWARD IMPLEMENTING POST-HARVEST PRACTICES IN SELECTED STATES OF PENINSULAR MALAYSIA

NUR AZIERA RUSLAN

FP 2014 17



VEGETABLE PRODUCER AND WHOLESALER ATTITUDES TOWARD IMPLEMENTING POST-HARVEST PRACTICES IN SELECTED STATES OF PENINSULAR MALAYSIA

NUR AZIERA RUSLAN

MASTER OF SCIENCE UNIVERSITI PUTRA MALAYSIA

2014



VEGETABLE PRODUCER AND WHOLESALER ATTITUDES TOWARD IMPLEMENTING POST-HARVEST PRACTICES IN SELECTED STATES OF PENINSULAR MALAYSIA



NUR AZIERA RUSLAN

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in the Fulfilment of the Requirement for the Degree of Master Science Agribusiness

February 2014

All material contained within the thesis, including without limitation text, logos, icons, photographs and all other artwork, is copyright material of Universiti Putra Malaysia unless otherwise stated. Use may be made of any material contained within the thesis for non-commercial purposes from the copyright holder. Commercial use of material may only be made with the express, prior, written permission of Universiti Putra Malaysia.

Copyright © Universiti Putra Malaysia



Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Master Science

VEGETABLE PRODUCER AND WHOLESALER ATTITUDES TOWARD IMPLEMENTING POST-HARVEST PRACTICES IN SELECTED STATES OF PENINSULAR MALAYSIA

By

NUR AZIERA RUSLAN

February 2014

: Associate Professor Norsida Man, Ph.D

Chairman

Faculty : Agriculture

Malaysia will continuously face impending international challenges and will affect its economic prospects considerably. With an increasing trend towards globalization, Malaysia will face sweeping technological changes in the production and processing of fresh produce, including fresh fruits and vegetables. Furthermore, in tandem with consumers' awareness regarding to health conscience, they demand for better quality and safe fresh produce that is convenient and ready to be consumed. The objective of this study is to gather information about the attitudes toward implementing postharvest practices among fresh leafy vegetable producer and wholesaler. This study also covers the reasons for implementing/not implementing the practice of postharvest, namely the practice of washing, sorting and grading, storage, packaging, and labeling.

This study used the data collected from a survey among fresh leafy vegetable producers and wholesalers using structured questionnaire. A total of one hundred and eighty three (183) respondents were interviewed in order to obtain a survey on their attitude and factors that influenced the respondents' attitude towards implementing post-harvest practices on fresh produce. A Likert scale of 1 to 5 (1 representing Strongly Disagree and 5 representing Strongly Agree) was used to measure respondents' opinion and attitude on the statements related to the practice of post-harvest. In this study, the descriptive analysis, factor analysis, and binary logistic regression were applied to analyze the gathered data.

The findings indicate that both producers and wholesalers mainly have positive attitudes toward implementing post-harvest practices even though there were problems in implementing the practices. The respondents' implementation of post-



harvest practices on fresh produce keeps on increasing due to consumers demand and requirement from the market.

Based on factor analysis, four (4) factors were identified to influence producers' attitudes toward implementing post-harvest practices. These factors are infrastructure, market availability, knowledge, and consumers' concern. Meanwhile, from the wholesalers' perspective, three (3) factors that influence wholesalers' attitudes toward implementing post-harvest practices were identified and the factors are consumers' concern, infrastructure, and market availability.

The binary logit model was used to examine the attitudinal characteristics of fresh vegetable producers and wholesalers such as infrastructure, market availability, consumers' concerns, knowledge, and socio-economic/demographic characteristics to determine the relative influence of socio-economic/demographic variables and other attributes on the attitudes toward the implementation of post-harvest handling practices. Research findings revealed that some of the parameters were significant in explaining the respondents' attitudes toward implementing post-harvest practices. From the producers' perspective, it was identified that there are three important determinants; infrastructure, market availability, and knowledge with significant predictors in explaining the producers' attitude towards implementing post-harvest practices. Meanwhile for wholesalers, it was identified that three important determinants; consumers' concerns, infrastructure, and availability of market are the significant predictors in explaining the wholesalers' attitude towards implementing post-harvest practices.

The concept of post-harvest practices is new in Malaysia but it becomes more popular among every player in the supply chain; from producers/growers to retailers as the society becomes more aware of the issues concerning to health and food safety. Besides that, it is important to improve the attitudes of every player in the supply chain in line with providing proper and sufficient infrastructure.

Furthermore, quality plays an important role in ensuring the competitiveness and sustainability of vegetables industry in Malaysia. Besides reducing post-harvest losses, appropriate, and efficient post-harvest technology also helps to maintain the quality of vegetables for an extended period. Appropriate post-harvest practices will increase added value to the fresh produce. Hence, the government, policy makers, related institutions, and food processers are responsible to educate and take action towards every player in the supply chain in implementing post-harvest practices.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk Ijazah Master Sains

SIKAP PENGELUAR DAN PEMBORONG SAYUR-SAYURAN SEGAR TERHADAP PELAKSANAAN AMALAN LEPAS TUAI DI NEGERI TERPILIH SEMENANJUNG MALAYSIA

Oleh

NUR AZIERA RUSLAN

Februari 2014

Pengerusi: Profesor Madya Norsida Man, Ph.D

Fakulti: Pertanian

Malaysia akan terus menghadapi pelbagai cabaran di peringkat antarabangsa yang akan memberi impak terhadap prospek ekonomi Malaysia. Dengan trend yang meningkat ke arah globalisasi, Malaysia akan menghadapi perubahan teknologi yang luas dalam pengeluaran dan pemprosesan produk segar, termasuk buah-buahan dan sayur-sayuran. Tambahan pula, sejajar dengan kesedaran pengguna mengenai kepentingan penjagaan kesihatan, mereka memerlukan hasil segar yang selamat dan mempunyai kualiti yang baik yang memudahkan serta sedia untuk dimakan. Objektif kajian ini adalah untuk mengumpul maklumat mengenai sikap terhadap pelaksanaan amalan lepas tuai di kalangan pengeluar dan pemborong sayur-sayuran daun segar. Kajian ini juga turut merangkumi sebab untuk mengamalkan/tidak mengamalkan amalan lepas tuai, iaitu amalan membasuh, mengagih, menggred, menyimpan, membungkus, dan melabel.

Kajian ini menggunakan data yang dikumpul melalui kerja lapangan yang dilaksanakan dalam bulan September hingga Disember 2012 di Kelantan, Pahang, Selangor, dan Kedah. Responden adalah dalam kalangan pengeluar dan pemborong sayur-sayuran segar dan menggunakan soal selidik berstruktur sebagai instrumen kajian. Seramai seratus lapan puluh tiga (183) responden telah ditemu bual bagi mendapatkan sikap dan faktor-faktor yang mempengaruhi sikap responden terhadap pelaksanaan amalan lepas tuai terhadap hasil segar. Skala Likert 1 hingga 5 (1 mewakili Sangat Tidak Setuju dan 5 mewakili Sangat Setuju) telah digunakan bagi tujuan mengukur pendapat responden terhadap penyataan berkaitan dengan amalan lepas tuai. Dalam kajian ini, analisis deskriptif, faktor analisis dan regresi logistik binari telah digunakan untuk menganalisis data yang dikumpulkan.



Hasil kajian menunjukkan bahawa pengeluar dan pemborong hasil segar mempunyai sikap yang positif terhadap amalan lepas tuai walaupun terdapat masalah dalam melaksanakan amalan lepas tuai. Amalan pelaksanaan lepas tuai di kalangan responden pada hasil segar terus meningkat disebabkan oleh permintaan daripada pengguna dan keperluan pasaran.

Berdasarkan analisis faktor, empat (4) faktor telah dikenal pasti mempengaruhi sikap pengeluar dalam pelaksanaan amalan lepas tuai, manakala tiga (3) faktor telah dikenal pasti mempengaruhi amalan pemborong dalam pelaksanaan pengendalian lepas tuai. Bagi pengeluar, faktor-faktornya adalah infrastruktur, ketersediaan pasaran, dan keprihatinan pelanggan ,manakala bagi pemborong, faktor-faktornya adalah keprihatinan pelanggan, infrastruktur, dan ketersediaan pasaran.

Model binari logit meneliti ciri-ciri sikap pengeluar sayur-sayuran segar dan pemborong seperti infrastruktur, ketersediaan pasaran, keprihatinan pengguna, pengetahuan dan ciri-ciri sosio-ekonomi/demografi untuk melihat pengaruh pemboleh ubah sosio-ekonomi/demografi dan sifat-sifat lain ke atas sikap terhadap pelaksanaan amalan lepas tuai. Hasil penyelidikan mendedahkan bahawa beberapa parameter penting dalam menerangkan sikap responden terhadap pelaksanaan amalan lepas tuai. Dari perspektif pengeluar, tiga faktor penting telah dikenal pasti dalam menjelaskan sikap pengeluar terhadap pelaksanaan amalan lepas tuai iaitu infrastruktur, ketersediaan pasaran, dan ilmu pengetahuan. Manakala bagi pemborong, adalah dikenal pasti bahawa tiga penentu penting termasuk kebimbangan pengguna, infrastruktur, dan ketersediaan pasaran adalah peramal yang signifikan dalam menjelaskan sikap pemborong terhadap pelaksanaan amalan lepas tuai.

Konsep amalan lepas tuai masih baru di Malaysia tetapi ia menjadi penting pada masa kini di kalangan setiap pemain dalam rantaian bekalan bermula daripada pengeluar/penanam kepada peruncit kerana masyarakat sekarang menjadi lebih sedar dan peka terhadap isu-isu berkaitan dengan kesihatan dan keselamatan makanan. Selain itu, infrastruktur yang sesuai dan mencukupi untuk pelaksanaan amalan lepas tuai perlu disediakan.

Kualiti pengeluaran hasil segar perlu diberi keutamaan untuk memastikan pengeluar dan pemborong boleh bersaing dan industri sayur-sayuran dapat berkembang secara mampan di Malaysia. Selain itu, kerugian lepas tuai perlu dikurangkan, penggunaan teknologi lepas tuai yang sesuai dan berkesan perlu ditingkatkan untuk membantu mengekalkan kualiti sayur-sayuran dalam suatu tempoh yang panjang. Pengendalian lepas tuai akan meningkatkan nilai tambah pada hasil segar. Oleh itu, kerajaan, pembuat dasar, institusi yang berkaitan, dan pengeluar makanan harus memainkan peranan penting, bertanggungjawab dan berganding bahu dalam mendidik dan mengambil tindakan ke atas setiap pemain dalam rantaian bekalan bagi melaksanakan amalan lepas tuai.

ACKNOWLEDGEMENTS

A lot of thanks and appreciation goes to the following institution and individuals that helped me throughout my study.

I would like to sincerely thank my lovely and supportive supervisor, Associate Professor Dr. Norsida Man, who always help and encourage me during the study. I am so grateful for the knowledge, advice, and timely help that she offered. Thank you very much for your guidance from the beginning until the end of my study. Many thanks go to my committee members, Dr. Nolila Nawi and Associate Professor Dr. Phebe Ding for the knowledge that we shared, guidance, and encouragement that I received. Your guidance availed me an opportunity to widen my academic knowledge. The useful suggestions given are highly appreciated. I would also like to thank all lecturers and staffs at the Department of Agribusiness and Information Systems and Faculty of Agriculture for their kindness and helpfulness towards me throughout my study in UPM. Their help, encouragement, and moral support make my study ease and smooth.

I would like to express my great appreciation and sincere gratitude to the State Department of Agriculture (Pahang, Kelantan, Selangor, and Kedah) and Federal Agricultural Marketing Authority (FAMA) for their cooperation, support, and information throughout the research. Their great commitments really help me to complete the research within the given period. To all the respondents, thank you very much for spending your precious time in helping me to complete the questionnaire. I really appreciate your kind cooperation.

My acknowledgement also goes to all my friends (Farah, Hayati, Rahim, and Raidah) and coursemates (Fatimah, Liyana, Hazwani, Nasihah, Melissa, and Shalini). You guys are really supportive friends. Thanks for always be there by my side in good and hard times. Last but not least, a special feeling of gratitude to my loving parents, Ruslan Saleh and Salehah Abd Wahab, my brother, Kufaizul Rastam Ruslan, my aunt, Salehana Abd Wahab, who encourage and provide never ending support all the way since the beginning of the study. Family love was a great source of motivation and inspiration. Also, praise to ALLAH for easing my way. Alhamdulillah.



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

Norsida Man, PhD

Associate Professor Faculty of Agriculture Universiti Putra Malaysia (Chairman)

Nolila Mohd Nawi, PhD Senior Lecturer

Faculty of Agriculture Universiti Putra Malaysia (Member)

Phebe Ding,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:

DECLARATION

Declaration by graduate student

I hereby confirm that:

- this thesis is my original work;
- quotations, illustrations and citations have been duly referenced;
- this thesis has not been submitted previously or concurrently for any other degree at any other institutions;
- intellectual property from the thesis and copyright of thesis are fully-owned by Universiti Putra Malaysia, as according to the Universiti Putra Malaysia (Research) Rules 2012;
- written permission must be obtained from supervisor and the office of Deputy Vice-Chancellor (Research and Innovation) before thesis is published (in the form of written, printed or in electronic form) including books, journals, modules, proceedings, popular writings, seminar papers, manuscripts, posters, reports, lecture notes, learning modules or any other materials as stated in the Universiti Putra Malaysia (Research) Rules 2012;
- there is no plagiarism or data falsification/fabrication in the thesis, and scholarly integrity is upheld as according to the Universiti Putra Malaysia (Graduate Studies) Rules 2003 (Revision 2012-2013) and the Universiti Putra Malaysia (Research) Rules 2012. The thesis has undergone plagiarism detection software.

Signature:	Date:
-	

Name and Matric No.:

Declaration by Members of Supervisory Committee

This is to confirm that:

- the research conducted and the writing of this thesis was under our supervision;
- supervision responsibilities as stated in the Universiti Putra Malaysia (Graduate Studies) Rules 2003 (Revision 2012-2013) are adhered to.

Signature:Name of Chairman of Supervisory	Signature: Name of Member of Supervisory
Committee:	Committee:
Signature:	Signature:
Name of	Name of
Member of	Member of
Supervisory	Supervisory
Committee:	Committee:

TABLE OF CONTENTS

	Page
ABSTRACT	i
ABSTRAK	iii
ACKNOWLEDGEMENTS	V
APPROVAL	vi
DECLARATION	viii
LIST OF TABLES	xiv
LIST OF FIGURES	xvi
LIST OF ABBREVIATIONS	xvii

CHAPTER

I.	INTRO	DUCTION	
	1.1	Introduction	1
	1.2	Overview of Vegetables Sector in Malaysia	1
	1.3	Government Policy on Malaysia Agriculture Focusing	3
		on Vegetables Sector	
		1.3.1 Third National Agriculture Policy (NAP3)	4
		1.3.2 Agriculture National Key Economic Area	4
		(NKEA)	
		1.3.3 National Agrofood Policy (2011-2020)	5
		1.3.3.1 Increasing the Productivity and	5
		Expansion Area of Vegetables	
		Production	
		1.3.3.2 Improving the Method of Post-harvest	6
		Handling and Marketing Logistic	
		Facilities	
		1.3.3.3 Strengthening of Organic Vegetables	6
		Market	
	1.4	Players in Fresh Vegetables Supply Chain	6
	1.5	Practices of Post-harvest along Vegetables	6
		Market Channels	
	1.6	Issues and Challenges in Malaysian Fresh Vegetables	8
		Industry	
	1.7	Problem Statement	10
	1.8	Objectives of the Study	11
	1.9	Significance of the Study	12
		1.9.1 Consumers	13
		1.9.2 Producers, Wholesalers and Marketers	13
		1.9.3 Academicians and Researchers	13
		1.9.4 Legislators	14
	1.10	Thesis Organization	14

II. LITERATURE REVIEW

 \bigcirc

	2.1	Introduction	15
	2.2	Post-harvest Practices in Malaysia	15
		2.2.1 Maturity and Harvesting	16
		2.2.2 Washing	16
		2.2.3 Sorting and Grading	16
		2.2.4 Packaging	17
		2.2.5 Labeling	17
		2.2.6 Storage	17
	2.3	Previous Studies on Attitude	18
	2.4	Fresh Vegetable Quality Attributes and Grade Standards for Marketing	19
	2.5	Post-harvest Losses of Horticultural Perishables	21
	2.6	General Post-harvest Factors that Contribute to Post-	22
		harvest Losses of Fresh Vegetables	
		2.6.1 Strategies for Improving Handling	22
	2.7	Value Chain Development Concept to Enhance Post-	23
		harvest Handling of Fresh Vegetables	
	2.8	Factors that Influence Attitude towards Implementing	24
		Post-harvest Practices	
		2.8.1 Infrastructure	24
		2.8.2 Market Availability	24
		2.8.3 The Impact of High Quality of Fresh Produce on	25
		Consumers Purchasing Behavior	
		2.8.4 Knowledge	26
	2.9	Institutions and Agencies Involved in Food Safety	27
		Awareness and Regulations in Malaysia	
	2.10	Summary	28
III.	METH	HODOLOGY	
	3.1	Conceptual Framework	29
	3.2	Location of the Study	30
	3.3	Data Collection	31
		3.3.1 Population Sample	31
		3.3.2 Sampling Technique	32
		3.3.3 Source of Data	
		3.3.3.1 Primary Data	33
		3.3.3.2 Secondary Data	33
		3.3.4 Questionnaire Design	34
		3.3.5 Pilot Study	35
	3.4	Data Analysis	
		3.4.1 Descriptive Analysis	35
		3.4.2 Factor Analysis	36
		3.4.3 Logit Regression Model	37
	3.5	Summary	41

IV. RESULTS AND DISCUSSION

4.1	Analysis of Socio-economic Profile of Respondents	42
	4.1.1 Socio-economic Profile of Fresh Vegetable	42
	Producers	
	4.1.2 Socio-economic Profile of Fresh Vegetable	44
	Wholesalers	
	4.1.3 Implementation of Post-harvest Practices among	46
	Fresh Vegetable Producers	
	4.1.3.1 Harvesting Time of Fresh Vegetables	46
	among Producers	
	4.1.3.2 Implementation of Washing Practices	46
	among Fresh Vegetable Producers	
	4.1.3.3 Implementation of Sorting and Grading	48
	Practices among Fresh Vegetable	
	Producers	
	4.1.3.4 Implementation of Packaging Practices	49
	among Fresh Vegetable Producers	.,
	4135 Implementation of Labeling Practices	51
	among Fresh Vegetable Producers	01
	4 1 3 6 Duration of Selling Vegetables at Market	52
	4 1 4 Implementation of Post-harvest Practices	52
	amongst Fresh Vegetable Wholesalers	52
	4 1 4 1 Implementation of Sorting and Grading	52
	Practices among Fresh Vegetable	52
	Wholesalers	
	4142 Implementation of Storage Practices	54
	among Fresh Vegetable Wholesalers	Эт
	4143 Implementation of Re-Packaging	55
	Practices among Fresh Vegetable	55
	Wholesalers	
	A 1 A A Implementation of Labeling Practices	56
	among Fresh Vegetable Wholesalers	50
	4145 Duration of Selling Vegetables at the	58
	Market	50
	A 1.5 Attitudes towards Implementing Post-harvest	
	Practices	
	A 1 5 1 Producers' Attitude towards	58
	Implementing Post-harvest Practices	50
	A 1 5 2 Wholesalers' Attitude towards	60
	Implementing Post-harvest Practices	00
12	Factor Analysis	
7.2	4.2.1 Measure of Sampling Adequacy	62
	4.2.2 Communality	64
	4.2.2 Communanty 4.2.3 Varimax Normalization	65
	4.2.4 Figenvalue Criteria	66
	4.2.5 Factors that Influence the Attitude towards	00
	Implementing Post-harvest Practices	
	4 2 5 1 Producers' Perspectives	66
	1.2.3.1 1 10000015 1 015p001105	68
		00

4.2.6 Variance Explained	70
4.2.7 Reliability Test	71
4.3 Binary Logit Model	
4.3.1 Producers' Attitudes towards Implementing	72
Post-harvest Practices	
4.3.1.1 Estimation of Logit Model for Producers'	73
Attitudes towards Implementing Post-	
harvest Practices	
4.3.2 Wholesalers' Attitudes towards Implementing	74
Post-harvest Practices	
4.3.2.1 Estimation of Logit Model for	75
Wholesalers' Attitudes towards	
Implementing Post-harvest Practices	
4.4 Summary	76
V. CONCLUSION AND RECOMMENDATIONS	
5.1 Introduction	77
5.2 Summary	77
5.3 Conclusion	79
5.4 Recommendations	79
5.5 Marketing Implications	80
5.6 Food Safety Implications	81
5.7 Limitations of the Study	82
5.8 Recommendation for Future Study	82
REFERENCES	84
BIODATA OF STUDENT	93

 \bigcirc

LIST OF TABLES

Table		Page
1.1	Production and Planted Area for Vegetables in Peninsular Malaysia, 2007-2011	2
1.2	New Area Opening for Plantation of Fresh Vegetables (hectares), 2011-2020	6
2.1	Postharvest Losses Estimation of Fresh Fruits and Vegetables (FFV) in Selected Asian Countries	22
3.1	Planted Areas and Production of Vegetable at Selected States in Peninsular Malaysia	30
3.2	The Distribution Number of Producers by States	32
3.3	The Distribution Number of Wholesalers by States	33
3.4	Explanatory Variables to Measure the Producers' Attitudes towards Implementing Postharvest Practices	40
3.5	Explanatory Variables to Measure the Wholesalers' Attitudes towards Implementing Postharvest Practices of Fresh Vegetable Wholesalers	41
4.1	Demographic Profile of Fresh Vegetable Producers	42
4.2	Demographic Profile of Fresh Vegetable Wholesalers	45
4.3	Harvesting Time	46
4.4	Distribution of Producers by Washing Practices	47
4.5	Reasons for Washing the Produce or Not	47
4.6	Distribution of Producers by Sorting and Grading Practices	48
4.7	Reasons for Sorting and Grading the Produce or Not	48
4.8	Distribution of Producers by Packaging Practices	49
4.9	Reasons for Packing the Produce or Not	50
4.10	Distribution of Producers by Labeling Practices	51
4.11	Reasons for Labeling the Produce or Not	51
4.12	Duration of Selling Vegetables to the Market (n=121)	52

4.13	Distribution of Wholesalers by Sorting and Grading Practices	53
4.14	Reasons for Sorting and Grading the Produce or Not	53
4.15	Distribution of Wholesalers by Storage Practices	54
4.16	Reasons for Storing the Produce or Not	54
4.17	Distribution of Wholesalers by Re-Packaging Practices	55
4.18	Reasons for Re-Packaging the Produce or Not	56
4.19	Distribution of Wholesalers by Labeling Practices	57
4.20	Reasons for Labeling the Produce or Not	57
4.21	Duration of Selling Vegetables at the Market (n=62)	58
4.22	Producers' Attitudes on Postharvest Practices	59
4.23	Wholesalers' Attitudes on Postharvest Practices	61
4.24	KMO and Bartlett's Test for Producers	63
4.25	KMO and Bartlett's Test for Wholesalers	63
4.26	Communalities for Producers	64
4.27	Communalities for Wholesalers	65
4.28	Summary of Factor Analysis Results for Producers	67
4.29	Summary of Factor Analysis Results for Wholesalers	69
4.30	Results of Variance Explained for Producers	70
4.31	Results of Variance Explained for Wholesalers	71
4.32	The Reliability Test for Producers	72
4.33	The Reliability Test for Wholesalers	72
4.34	Estimation of Logit Model for Producers' Attitude towards Implementing Postharvest Practices	74
4.35	Estimation Logit Model for Wholesalers' Attitude towards Implementing Postharvest Practices	75

LIST OF FIGURES

Figure		Page
1.1	Per Capita Consumption of Vegetables (kg), 2009-2015	2
1.2	Import and Export of Vegetables (RM'000), 2005-2011	3
1.3	Players in Fresh Vegetables Supply Chain	7
1.4	The New Supply Chain and the Role of Technology in Business Process	9
3.1	Conceptual framework	29
3.2	Location of the Study	31

LIST OF ABBREVIATIONS

ACDA	Agricultural Concentrated Development Area
ASEAN	Association of Southeast Asian Nations
DOA	Department of Agriculture
EPP	Entry Point Projects
ETP	Economic Transfer Program
EU	European Union
FAMA	Federal Agriculture Marketing Authority
FELCRA	Federal Land Consolidation and Rehabilitation Authority
FELDA	Federal Land Development Authority
GAP	Good Agriculture Practice
GAHP	Good Animal Husbandry Practices
GAqP	Good Aquaculture Practices
GDP	Gross Domestic Product
GMF	Genetically Modified Food
GMO	Genetically Modified Organism
GLOBAL GAP	Global Good Agricultural Practices
ICT	Information and Communications Technology
КМО	Kaiser-Meyer-Olkin
MOA	Ministry of Agriculture
NAP	National Agro-food Policy
NAP3	Third National Agricultural Policy
NKEA	Agriculture National Key Economic Area
RISDA	Rubber Industry Smallholders Development Authority
SOM	Malaysian Organic Scheme

SSL Self-Sufficiency Level

TKPM Permanent Food Production Park

VHM Veterinary Health Mark



CHAPTER 1

INTRODUCTION

1.1 Introduction

Malaysia is currently a net importer of fresh vegetables, where the government aims to substantially increase vegetables production with a view of achieving selfsufficiency and becoming a net exporter (Ninth Malaysia Plan, 2006-2010). The vegetables sector provides opportunities for export diversification, poverty alleviation, and rural development. At the same time, vegetable producers are facing dynamic and rapidly changing markets because of the underlying factors, such as changing of consumers' tastes and preferences, weather pattern, regulatory legislation, insect/disease infestations, rising production costs, and marketing logistics.

1.2 Overview of Vegetables Sector in Malaysia

Fresh vegetable is an important dietary component in daily food intake of Malaysian people as they contain important sources of minerals, vitamins, and fibers in the daily diet. There are more than 50 types of tropical and temperate vegetables consumed locally, which makes about 15 percent of calories intake of Malaysian diet. The vegetables are categorized either as leafy, fruit, root, and others, or groups of commodities under cash crops (maize, groundnuts, cassava, yam, and sweet potatoes) and spices (hot chilli, ginger, and lemon grass). Most vegetables are annuals (e.g. tomatoes and potatoes), while others are biennials (e.g. asparagus). A fresh vegetable is highly perishable. Hence, they require careful handling and quick turnaround between farm and market, and preferably cooling during storage and transportation. Many vegetables share a common marketing system. For example, wholesale markets are responsible to handle most types of vegetables.

The prospect for Malaysian vegetable industry is bright and it is a comparatively profitable subsector in Malaysia. Most of the vegetables are grown by small farmers who live in the edge of densely populated town. Temperate vegetables with higher values such as tomatoes, carrot, cabbage, cauliflower, and broccoli are grown on high land. The plantation areas of vegetable at Malaysia show an increasing rate over the years with the opening of new lands and the development of existing areas of vegetable crops plantation. The production of vegetables also keeps increasing every year in tandem with the planted area. Table 1.1 presents the total production and planted area of vegetables from 2007 to 2011.

Year	Production (tonnes)	Planted area ('000 hectares)
2007	456,992.0	36.0
2008	490,963.0	37.7
2009	623,457.0	41.1
2010	870,251.0	52.8 ^r
2011	874,602.0 ^p	53.1 ^p

Table 1.1: Production and Planted Area for Vegetables in Peninsular Malaysia,2007-2011

Source: Agrofood Statistics, Ministry of Agriculture (MOA), 2011

The figures of per capita consumption of vegetables are shown in Figure 1.1. The trends of vegetable per capita consumptions are increasing yearly. In 2009, per capita consumption of vegetables was 45.2 kg, and it is estimated to increase to 50 kg in the year 2015. Malaysians are expected to consume higher values commodities and proteins with the increasing of household income, urbanization, changing of consumer taste, and market development. According to MOA on the estimation of per capita consumption of major food commodities, Malaysians are eating more vegetables than they did 20 years ago. The demand for vegetable has shifted substantially over the past two decades as incomes have risen and consumer tastes and preferences have changed. Per capita consumption of vegetables has increased, driven largely by gains in the fresh-market use. Since most of the fresh vegetables can be classified as normal goods (demand increases as income rises), the strong economic growth that has prevailed during the period has also helped to boost for higher consumption.



Figure 1.1: Per Capita Consumption of Vegetable (kg), 2009-2015

Source: Federal Agriculture Marketing Authority (FAMA), 2011

The values for import and export of vegetables in Malaysia (2005-2011) are shown in Figure 1.2. Malaysia is a net importer of vegetable as our local production does not able to meet the demands from consumers. In 2011, Malaysia exported RM 750,909.70 of vegetables and imported RM2,734,390.80. Malaysia has always experienced a negative trade balance. The domestic market is generally the primary market for most home-grown vegetables, while most of the exports are destined for Singapore market. The other market destinations are Indonesia, Thailand, China, and Brunei. The major vegetables exported are choy sum, cabbage, cucumber, long bean, red chilli, and tomatoes.

Malaysia imported RM 2,734,739.80 of vegetables in 2011. China has emerged as the primary source for Malaysia's vegetable imports, mainly for garlic, potatoes, carrots, turnips, onions, cabbages, cauliflowers, broccoli, and ginger. Other leading sources of Malaysia's vegetable imports are India (mainly onions, potatoes, and spices), Indonesia (cabbages and potatoes), Thailand (onions, cabbages, and tomatoes), Australia (carrots, turnips, and tomatoes), New Zealand (onions and other frozen vegetables), and the US (mainly potatoes). In general, over the recent years, the major importer of fresh and canned vegetables is China, while frozen vegetables are imported dominantly by the US and New Zealand, whereas Malaysia imports fresh temperate vegetables from Australia.



Figure 1.2: Import and Export of Vegetables (RM'000), 2005-2011

Source: Ministry of Agriculture (MOA), 2011

1.3 Government Policy on Malaysian Agriculture Focusing on Vegetables Sector

Malaysian government has outlined several policies for the development of vegetables industry, including the National Agro-food Policy NAP (2011-2020) and the Agriculture National Key Economic Area (NKEA). The basic policies and strategic directions for vegetable industry has been outlined in the Third National Agricultural Policy, NAP3 (1998-2010) and amplified by the Ministry of Agriculture and Agro-based Industries through its key agencies (Thiran, 2004).

1.3.1 Third National Agriculture Policy (NAP3)

The Third National Agriculture Policy (NAP3) was launched to optimize the utilization of existing resources in order to further improve competitiveness while maximizing agriculture's contribution to national income and export earnings, as well as maximizing income for the producers. The specific objectives of the policy are: (i) to enhance food security, (ii) to increase productivity and competitiveness of the sector, (iii) to deepen linkages with other sectors, (iv) to create new sources of growth for the sector, and (v) to conserve and utilize natural resources on a sustainable basis.

Vegetable production will be further expanded to fulfill the demand from local and export market. The government will zone suitable state land, existing production areas, and non-granary areas near urban centers as permanent vegetable areas and leased to the private sector. They will continue to provide institutional support, infrastructure, and incentives to encourage private sector to venture into large-scale commercial production. In order to cater the increasing demand in niche markets, fresh vegetables and newly processed products, such as minimally-processed vegetables, flour-based products, natural food ingredients, functional food, vegetarian and reformulated vegetarian food products, modified food ingredients, high fiber products, convenience food and beverages, and by-product utilization will be upgraded and exploited.

To meet the domestic and export market requirement, the use of high technology production in high value temperate vegetables on the lowlands will be promoted. Besides that, R&D efforts on cost-effective production, postharvest handling, and processing will be intensified with particular emphasis on agricultural mechanization and labor-saving techniques. The marketing system will be upgraded by improving efficiency of the existing marketing channels and further develop the parallel marketing channel.

1.3.2 Agriculture National Key Economic Area (NKEA)

Malaysian government launched the National Key Economic Area (NKEA) in 2010 to boost the growth of Malaysia's economy. NKEA is defined as a driver to potential economic activities that will directly and significantly contribute to Malaysia's economic growth. There are 12 elements in NKEAs which are the cores of ETP, and one of them is the Agriculture NKEA. The agriculture sector still plays an important role in the development of Malaysia's economy as the sector that provides job opportunities, increases rural income, and ensuring sufficient national food supply.

Agriculture NKEA focuses on subsectors that have high potential of growth including aquaculture, seaweed farming, edible swiftlet nests, herbal products, fruits and vegetable, and premium processed food. There is an increasing demand for these

high-value products which provides opportunities for farmers to increase their income. This will enable Malaysia to penetrate the high-value global market which is growing rapidly. A total of 16 Entry Point Projects (EPP) and 11 business opportunities have been identified to catalyze the business driven by market demand, of industrial scale, and characterized by integrated agriculture. One of the 16 EPPs is EEP 7, where the government wants to upgrade capabilities to produce fruit and vegetable for premium markets. In order to tap the premium market, Malaysia has to produce high quality fresh fruits and vegetables to be exported by performing appropriate postharvest handling practices. Malaysian government is taking seriously in the development of vegetables industry as there is an increasing demand from the local market and because of their importance as the sources of vitamins and provides fiber for digestion.

1.3.3 National Agrofood Policy (2011-2020)

Increasing consumer awareness towards health care is expected to provide opportunities for the increasing in fresh vegetable production and product development based on minimally processed products including vegetable juice, functional foods, frozen vegetables, high-fiber vegetables, and pickled vegetables. Therefore, Malaysian government has launched the National Agrofood Policy, NAP (2011-2020) to strengthen the vegetables industry. The policy outlines four strategies to ensure adequate food supply, increase the added value of the agro-food sector, compliment and strengthen the supply chain, as well as provide trained labor for the agriculture sector.

Throughout this policy, the government has outlined several strategies for the development of vegetable industry in reducing the dependency on imported vegetables, including (i) increasing the productivity and expansion area of vegetables production, (ii) improving the method of postharvest handling and marketing logistic facilities, and (iii) strengthening organic vegetables market.

1.3.3.1 Increasing the Productivity and Expansion Area of Vegetables Production

The strategies to increase the opening of new area of 8,000 hectares will be implemented as follows: (i) develop new areas through Permanent Food Production Park (TKPM), Idle Land Project, and Groups Farming Project, as well as to encourage organic vegetables farming and commercial-scale private farms, (ii) promote the integration of vegetable crops with rubber and oil palm plantations in RISDA, FELDA, and FELCRA; and (iii) develop rural granary area for vegetable crops. The opening of new areas will be implemented by the Department of Agriculture, private sectors, and GLCs, as shown in Table 1.2.

No.	Implementers	Hectares (ha)
1.	Department of Agriculture	
	a) Permanent Food Production Park (TKPM)	650
	b) Agricultural Concentrated Development Are	ea 70
	(ACDA)	220
	c) Commercial Vegetable	
2.	Sarawak	350
3.	Sabah	260
4.	Private/Estate	5,650
5.	Other Agencies	1,100
	Tot	al 8,300

Table 1.2: New Area Opening for Plantation of Fresh Vegetables (hectares),2011-2020

Source: Ministry of Agriculture & Agro-Based Industry, 2011

1.3.3.2 Improving the Method of Postharvest Handling and Marketing Logistic Facilities

Efforts will be made to improve the awareness and knowledge on the aspects of postharvest handling, packaging, and storage of vegetables to ensure the quality of vegetables and to reduce postharvest losses. Compliance with 3P's Regulations below Federal Agricultural Marketing Authority (FAMA) will be expanded to assure the quality of local and imported vegetables. Facilities in the collection center, grading, and distribution will be fully utilized and used extensively to strengthen the marketing of fresh vegetables.

1.3.3.3 Strengthening Organic Vegetables Market

Consumer awareness towards vegetables that are free from chemicals and safe to consume is expected to increase the demand for organic vegetables, including salads and viand. Efforts will be intensified to encourage the production of organic vegetables with the premium price through the expansion of focus area for organic farming and the implementation of Malaysian Organic Scheme (SOM).

1.4 Players in Fresh Vegetables Supply Chain

The players in the fresh vegetables supply chain in Malaysia consist of producers, collectors or transporters, wholesalers, retailers and/or supermarkets. A proper supply chain management would benefit all the players involved in the production

and marketing of fresh vegetables. Consumers would also share the benefit of having better produce that are safe and ready to be consumed.

In the study done by Norsida *et al.*, (2007), it was suggested that at the first marketing level, a major portion of the producers' produce, which is 64 percent, goes to the wholesalers. Another 26 percent goes to the collectors/transporters, 7 percent to the retailers, 2 percent to the direct marketers (e.g. FAMA), and the remaining 1 percent to the hypermarkets. At the collection center, 59 percent of the produce continues with the wholesalers, while 41 percent goes to the retailers. From the main wholesalers, 46 percent trickles down to the other wholesalers, 27 percent goes to the institutional buyers, 24 percent goes to the retailers, and the remaining 3 percent goes to the hypermarkets. At the other wholesale level, 55 percent goes to the retailers, 25 percent goes to the hypermarkets, and 20 percent goes the institutional buyers (Figure 1.3).



Figure 1.3: Players in Fresh Vegetables Supply Chain

Source: Norsida et al., (2007)

1.5 Practices of Postharvest along Vegetables Market Channels

Vegetables move from the producers to the consumers through a number of players involved in marketing channels. The channels for fresh items emphasize on quality retention by moving the produce quickly from farm to consumers. Fresh produce usually passes through terminal wholesale markets before being sold to retailers. A small percentage of produce is marketed directly from the producers' farm to the final consumer. About 30 percent of vegetable supplies enter the export markets. Trucks and lorries (mostly non-refrigerated) are the vast majority of the domestic movement to transport fresh vegetables from the production areas to the population centers.

A growing number of private, large, and modern packing houses with on-site cold storage facilities move their products from the farm to the packing shed. The produce will be washed, sized, sorted, graded, packed, cooled in the packing shed, and loaded (mostly on lorry) for shipment to retailers, wholesalers/terminal markets, farm markets or export markets. The new agro-food paradigm has been characterized by consumer orientation, differentiated products, produce that are washed, graded, sorted and packed appropriately to reflect the quality, utilization of postharvest infrastructure and technology that will create value-added to the produce, and a vertical-integrated structure dominated by retailers as shown in Figure 1.4. Proper practices of postharvest on fresh produce enable large retail chains in the developed economy to satisfy the needs of consumers for high quality and safe product, as well as reducing postharvest losses along the supply chain.



Figure 1.4: The New Supply Chain and the Role of Technology in Business Process

Source: Hong (2005)

1.6 Issues and Challenges in Malaysian Fresh Vegetables Industry

Various issues in the Malaysian fresh vegetables industry have been reported, which limits the industry to enhance its competitiveness. Many problems have been identified, where the major problems faced by the industry include scarcity of land, inadequate proper postharvest infrastructure, limited financial condition, insufficient resources, and shortage of trained labours. Most lands are being utilized for other potential commodities such as oil palm, rubber, and coconut. In addition, majority of the fresh vegetables producers and wholesalers are practicing traditional method of postharvest, thus the freshness, quality and safety of vegetables cannot be ascertained. In Malaysia, the agriculture sector is characterized by a large number of small and uncommercialized farms (Fatimah, 2012). According to the Ministry of Agriculture (MOA) on agricultural land use, the cultivated area under vegetable is merely one percent of the total agricultural land use. Federal Agriculture Marketing Authority (FAMA, 2005) stated that there were 270,000 producers working on 257,000 ha of land planted with vegetables in 1998. Out of this amount, only 86,000 ha or 33.4 percent are considered as commercial farms, with average farm size of 0.68 ha. More than 80 percent of all vegetable producers have less than 0.5 ha and less than 4 percent of all vegetable producers have farm size of more than 1.0 ha (Chiew, 2007).

The potential to obtain a satisfactory farm income with limited resources, technology, and infrastructure is severely constrained. The number of farms which specialized in the vegetables production exceeded 13,327 farms in 2004. From the national agriculture survey in 1990, the number of farms harvesting vegetables has fallen close to 20 percent. Hence, the government and related agencies are taking action by intensifying the opening of new land for vegetables production. Apart from that, lack of infrastructure and technologies are also the problems faced by the producers and wholesalers to improve their production. Due to high maintenance cost, small scale producers and wholesalers are not in a position to own proper storage, cold rooms, warehouse, and transportation. This situation becomes one of the barriers to small scale producers and wholesalers to compete in the market, as the farm management is still in a low level and inefficient. Hence, some of them are unable to meet the requirement and demand for fresh vegetables.

Thus, to ensure the development and competitiveness of vegetable industry, the government has outlined several strategies. For example, the Department of Agriculture (DOA) has utilized idle land and develops new areas through Permanent Food Production Park (TKPM), Idle Land Project, and Groups Farming Project, as well as to encourage the producers to involve in proper and systematic farm management. Furthermore, FAMA has launch 3P's Regulations to assure the quality of local and imported fresh vegetables through proper packaging, labeling, and grading practices. The Ministry of Agriculture and Agro-based Industry and government agencies, especially DOA and FAMA, play an important role to develop vegetable industry by increasing the production of fresh and safe vegetable for local consumption, as well as for export.

1.7 Problem Statement

Malaysia is currently a net importer of fresh vegetables, where the government aims to increase vegetables production substantially, with a view to achieve self-sufficiency and become a net exporter (Ninth Malaysia Plan, 2006-2010). The problems associated with postharvest losses are of worldwide concern as world food demand increases. According to the five (5) principles outlined during the World Summit on Food Security, reducing postharvest losses is one of the resolutions endorsed during the assembly (FAO, 2009). One of the concerns now in this subsector is to provide safety produce and have qualification for export standard. To fulfill these requirements, the practice of postharvest should be implemented in fresh vegetable production.

Fresh vegetables are highly perishable commodities that are easily deteriorated or spoilt during produce handling along the supply chain from the producers to the end consumers. Abd. Shukor *et al.* (2003) reported those in ASEAN countries, improper handling and packaging, low-level technology, lack of basic equipment and facilities at the packing house, and lack of trained personnel commonly contribute to postharvest losses. In the study by Azizah (2009), 27 percent of fruits and vegetables were sent directly to the wholesaler without any postharvest handling activities. A majority of the farmers did not perform potential postharvest handling activities mainly because of insufficient knowledge. However, the Department of Agriculture (DOA) is actively developing expertise in the venture by training farmers and opening lands for organic vegetable production under its various assistance programs. The government also encourages small-scale producers to venture into organic farming as part of its strategy in raising producer's income.

Generally, vegetable industry in Malaysia can be considered as small and fragmented. The production is mainly for near market and can be distributed immediately. Thus, this results in unpracticed of postharvest. The farm size is small, and the producers practiced disorganized farm management techniques due to insufficient knowledge, limited infrastructure and technology, as well as high production cost.

Besides that, a large part of vegetable marketing is still traditional, characterized by their production approach, undifferentiated product, bulky nature, minimal grading, which lead to low added value, dominance of the wholesalers along the marketing chain, and essentially a producer pull market. In relation to marketing infrastructure as reported by Mad Nasir (2004), the factors that limit the vegetables sector are 1) farm collecting centers, 2) packaging house facilities, 3) cold rooms, 4) wholesale markets in production areas, and 5) transportation services. However, proper packing house operation and better handling system have been practiced by some growers on highly priced vegetables, especially for export market. It is important for exporter to follow the standards stated by the importer country.

Human factors such as handling practices and attitudes, and technological aspects such as improper infrastructure and handling techniques could contribute to postharvest losses. Appropriate postharvest handling practices are important to minimize postharvest losses and to maintain the quality of fruits and vegetables. In developing countries, postharvest losses mostly occur during transportation, handling, storage, and processing (Barbosa-Cánovas *et al.*, 2003).

In view of the issues highlighted above, we have to find the solution for postharvest handling problems to ensure that Malaysia can produce safe and high quality vegetables for local consumption and export. Therefore, a research was carried out to determine the producers' and wholesalers' attitude towards implementing postharvest practices.

There are several research questions that can be raised in this study including:

- 1) What is the current practice of postharvest amongst Malaysian vegetable producers and wholesalers?
- 2) What is the implementation status of postharvest handling practices?
- 3) What are the reasons for implementing or not implementing postharvest handling practices on fresh produce?
- 4) What are the factors that influence the producers' and wholesalers' attitude towards implementing postharvest practices?
- 5) What is the extent to which selected socio-demographic characteristics and selected independent variables influence the respondents' attitude towards implementing postharvest practices?

1.8 Objectives of the Study

The general objective of this study was to determine the producers' and wholesalers' attitude towards implementing postharvest practices in selected states of Peninsular Malaysia.

The specific objectives for this research were:

- 1) To identify the current practice of postharvest amongst Malaysian vegetable producers and wholesalers.
- 2) To analyze the factors that influences the respondents' attitude towards implementing postharvest practices.
- 3) To determine the extent to which selected socio-demographic characteristics and selected independent variables influence the respondents' attitude towards implementing postharvest practices.

1.9 Significance of the Study

The findings of the study will provide a clear picture about the fresh vegetable producers' and wholesalers' attitude towards implementing postharvest practices in selected states of Peninsular Malaysia. The research finding is expected to provide knowledge on factors that influence the producers' and wholesalers' attitude towards implementing postharvest practices. This study will be significant to the following groups:

1.9.1 Consumers

Consumers nowadays are demanding for fresh produce which is safe, nutritious, fresh, and ready to be consumed. With the increase of living standard and tremendous purchasing power, the consumers are able to buy high quality of fresh produce, as well as maintain their health. The implementation of postharvest practices on fresh produce will minimize postharvest losses and maintain the quality and freshness of fresh produce. Thus, consumer will receive greater benefit of having better produce that are fresh and safe to consume.

1.9.2 Producers, Wholesalers and Marketers

This research finding will provide the producers with information, knowledge, and better understanding of postharvest practice. The producers are ultimately responsible for keeping the fresh produce in good condition. Knowledge and understanding on the importance of implementation of postharvest practices on fresh produce, as well as market demand and consumers need, can increase the income of producers and wholesalers. They can add value to the produce by performing the practice of washing, sorting and grading, packaging, and labeling. This study will provide a guide for them to formulate effective marketing strategies. With appropriate knowledge, they are capable of creating competitive advantage in the marketplace.

1.9.3 Academicians and Researchers

This research will serve as a future reference for researchers who have interest to study in the same area of study, especially for those focusing on the national interest in learning and understand the practice of postharvest.

1.9.4 Legislators

The legislators are responsible to provide and fulfill the needs of the society and nation. Food legislation represents the minimum standard laid down by the government to ensure the needs of population for safe and healthy food, information and protection from unfair trade practices. They can use the findings from this study in planning new strategies for policies in improving the development of vegetables industry. They can also use the findings to develop appropriate postharvest technology to minimize postharvest losses and maintain the quality and freshness of fresh produce throughout the supply chain until it reaches the final players; the consumers.

1.10 Thesis Organization

This section covers the organization of this study. This study consists of five chapters covering different areas of the study. The introduction in Chapter 1 gives vast knowledge of postharvest practices and a clear picture of the issues involved in the study. The chapter contains the introduction, problems statement, objectives, research questions, and significance of the study.

Chapter 2 summarizes previous literatures and findings related to the postharvest practices, postharvest losses, as well as previous studies on attitude and value chain. The methodology adopted in this study is presented in detail in Chapter 3. The chapter discusses about the research design including questionnaire as the instrument of the study, detail about the location of study, population and sample method, data collecting technique, and the analysis conducted for the study.

Chapter 4 summarizes the results and analysis of this study, while Chapter 5 discusses the conclusion and provides recommendations for future study related to this field.

REFERENCES

- Abbott, J.C. (1987). Agricultural Marketing Enterprises for the Developing World. Australia: Cambridge University Press.
- Abd. Shukor, A. R., Mohd Salleh, P., Ahmad Tarmizi, S. and Pauziah, M. (2003).Development of Appropriate Postharvest Technologies for Major Vegetable Crops of ASEAN, Perspectives of ASEAN Cooperation in Vegetable Research and Development, Proceedings of the Forum on the ASEAN-AVRDC Regional Networkon Vegetable Research and Development (AARNET) in Kuo G. (Ed), http://www.avrdc.org/pdf/aarnet.proc/008.pdf
- Agreement, G., & Grant, B. (2010).Identification of Appropriate Postharvest Technologies for Improving Market Access and Incomes for Small Horticultural Farmers in Sub-Saharan Africa and South Asia, (52198), 1-29.

Agrofood Statistics, Ministry of Agriculture (MOA), 2011.

- Ajzen, I. (1989). Attitude and structure and behavior.In A.R. Pratkanis, S.J.Breckler and A.G.Greenward (Eds.), Attitude Structure Function. (pp. 241-275). Hilladale, New-Jersey: Erbaum.
- Ajzen, I. (1991). The Theory of Planned Behavior.Organizational Behavior and human Decision Processes, 50, 179-211.
- Ajzen, I. (2002). Perceived Behavioral Control, Self-Efficacy, Locus of Control, and the Theory of Planned Behavior.Journal of Applied Social Psychology, 32,665-683.
- Ajzen, I. (2006). Constructing a TPB questionnaire: Conceptual and methodological considerations.
 Available online at http://socgeo.ruhosting.nl/html/files/spatbeh/tpb.measurement.pdf [accessed 17th February 2012]
- Ajzen, I. & Fishbein, M. (1980). Understanding attitudes and predicting social behaviour. Englewood cliffs, New Jersey: Prentice Hall.

- Ajzen, I. and Fishbein, M. (1997). *Attitude-behavior relations: A theoretical analysis and review of empirical research*. Psychological Bulletin, 84, 888-918.
- Arshad, F. M., Mohamed, Z., & Latif, I. (2006,). Changes in agri-food supply change in Malaysia: Implications on marketing training needs. In Proceedings of the O/AFMA/FAMA Regional Workshop on Agricultural Marketing Training, Food and Agriculture Organization of United ations (FAO) and Agricultural and Food Marketing Association for Asia and the Pacific (AFMA).
- Azman, A., D'Silva, J. L., Samah, B. A., Man, N., & Shaffril, H. A. M. (2012). Comparative study on sustainable agriculture knowledge among Malaysian contract farmers. American Journal of Applied Science, 9(5), 673-67.
- Barbosa-Cànovas, G.V., Fernàndez-Molina, J.J., Alzamora, S.M., Tapia, M.S., López-Malo,A. and Chanes, J.W. (2003). Handling and Preservation of Fruits and Vegetables by Combined Methods for Rural Areas, Technical Manual FAO Agricultural Services Bulletin 149, Food and Agriculture Organization of the United Nations.
- Beuchat, L. R., & Ryu, J. H. (1997). Produce handling and processing practices. *Emerging infectious diseases*, 3(4), 459–565.
- Bonte, C.H. (1989). Prevention of Post-Harvest Food Losses: Fruits, Vegetables and RootCrops, FOA, Rome.
- Booth, R.H.; Burton, W.G. (1983). Future needs in potato post-harvest technology in developing countries. Agriculture, Ecosystems and Environment vol. 9 issue 3 May, 1983. p. 269-280.
- Bumbudsanpharoke, W. (2010). Economy and Environment Program for Southeast Asia Perceptions of Best Management Practices on Thai Citrus Farms and the Development of an Agri-Environmental Policy : A Case Study in the Ping River Basin, Thailand. Available online at: http://www.eepsea.net/pub/tr/12693989831Wimolphat_(TR)_-Perceptions on Best Management Practices.pdf [accessed 11th September
 - 2012]
- Burton, R. J. F. (2004). Reconceptualising the 'behavioural approach' in agricultural studies: A socio-psychological perspective. *Journal of Rural Studies*, 20, 359-371.

- Carreón, J. R., René, J. J., Niels, F., & Rob, V. H. (2011). A Knowledge Approach to Sustainable Agriculture. Retrieved from http://www.springer.com/978-94-007-0889-1 on 8 March 2014
- Caswell, J. A., Joseph, S., & Hall, S. (2006). Consumers' Food Safety, Environmental, and Animal Welfare Concerns, (413).
- Chopra,S& Meindl, P. (2007). *Supply chain management: Strategy, Planning and Operation*. Upper saddle River, New Jersey: Pearson.
- Christopher, M. (2005). Logistics and Supply Chain Management- Creating Value Adding Networks. Prentice Hall/ Financial Times.
- Christopher, M.L. (1992). Logistics and Supply Chain Management, London: Pitman Publishing.
- Cohen, J.W. (1998). *Statistical power analysis for the behavioral sciences* (2nded). Hillsdale, NJ: Lawrence Erlbaum Associates.
- Cooper, M. C. & Ellram, L.M. (1993). Characteristics of Supply Chain Management and the Implications for Purchasing and Logistics Strategy. *The International Journal of Logistics Management*, 4 (2): 13-24.
- Costello, A.B. & Osborne, J.W. (2005). Best Practices in Explanatory Factor Analysis: Four Recommendations for Getting the Most from your Analysis. *Practical Assessment, Research and Evaluation, 10*, 1-9.
- Department of Agriculture Malaysia (DOA) [Online] Available: <u>http://www.doa.gov.my</u> [accessed 26th September 2011]
- Department of Statistics Malaysia, [Online] Available: <u>http://www.statistics.gov.my/</u> [accessed 10th October 2011]
- Eagly, A. H. & Chaiken, S. (1993). The Psychology of attitudes. Fort Worth, TX: Harcourt Brace Jovanovich.

- Eastwood, D. B., Brooker, J. R., Hall, C. R., & Rhea, A. (2002). Small Produce Growers' Marketing Behaviours : A Case Study of Tennessee.
- Eighth Malaysia Plan (8th MP) 2001-2005, [Online] Available: www.epu.gov.my/en/eighth-malaysia-plan-2001-2005 [accessed 6th November 2011]
- Fatimah, M.A. & Khalid A.R. (2008). New Agri-food Marketing System: Structural and Impact Analyses, research report submitted to Federal Agricultural Marketing Authority, Malaysia, 205 pp.
- Fatimah, M.A. (2012). The New Supply Chain: Implications to the Fresh Fruits and Vegetables Sector in Malaysia. International Journal of Business and Social Research (IJBSR), 2(4), 256-282.
- Fatima, N., Batool, H., Sultana, V., Ara, J., & Ehteshamul-haque, S. (2009). Prevalance Of Post-Harvest Rot Of Vegetables And Pakistan, 41(6), 3185-3190.
- Fawcett, S.E., Ellram, L.M. & Ogden, J.A. (2007). *Supply Chain Management: From Vision to Implementation.* Upper Saddle River, New Jersey: Prentice Hall.
- Fawcett, S.E., & Magnan, G.M. (2001). Achieving World-Class Supply Chain Alignment: Benefits, Barriers, and Bridges. Arizona State University Research Park: Center for Advance Purchasing Studies.

Field, A. (2009). *Discovering Statistics Using SPSS* (3rded.). SAGE Publications Ltd.

- Fielding, K. S., McDonald, R., & Louis, W. R. (2008). Theory of planned behavior, identity and intentions to engage in environmental activism. *Journal of Environmental Psychology*, 28, 318-326.
- Hair, J. F., Anderson, E and Ronald, L.T. (1991).*Multivariate Data Analysis*.(5thed) Upper Saddle River: Prentice Hall.
- Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. (1998).*Multivariate data analysis*. (5th ed.) New Jersey: Prentice-Hall.

- Hanis, A., Abdul, I., Selamat, J., Shamsudin, M. N., & Radam, A. (2010). Demand for Food Safety Attributes for Vegetables in Malaysia. Environment Asia, 3(3). pp. 160-167. ISSN 1906-1714
- Hattam, C. (2006). Barriers to the adoption of organic agriculture: An investigation using the Theory of Planned Behaviour. In C. Atkinson, B. Ball, D. H. K.Davies, R. Rees, G. Russell, E. A. Stockdale, C. A. Watson, R. Walker, & D. Younie (ed.), *What can organic farming deliver? COR 2006* (pp. 73).
- Henneberry, S. R., Piewthongngam, K., & Qiang, H. (1999). Consumer Food Safety Concerns and Fresh Produce Consumption, 24(93), 98-113.
- Hong Hwan Kim (2005). How to Successfully Link Rural Producers to the Urban Market.*Paper prepared for presentation at the Seminar on 'Cooperative Integration of Agricultural Marketing' organized by International Agricultural Cooperative Organization (ICAO), Colombia.
- Hosmer, D. W. & Lemeshow, S. (1989). Applied logistic regression. New York: John Wiley & sons.
- Jinap, S., Shamsudin, M. N., and Dulatti, M. S. 2002. Food Safety in Malaysia. Pacific Food System Outlook 2002-2003.
- Josephat, P., & Ismail, A. (2012). A Logistic Regression Model of Customer Satisfaction of Airline. International Journal of Human Resource Studies, 2(4), 255–265.
- Kader, A. A., Morris, L. L., & Cantwell, M. I. (2001). Postharvest Handling and Physiology of Horticultural Crops, 1–65.
- Kader, A.A. and Rolle, R.S. (2003). Chapter 3: Postharvest Management Procedures that are Critical to Maintaining the Quality and Safety of Horticultural Crops, In: *The Role of Postharvest Management in Assuring the Quality and Safety of Horticultural Produce*. FAO Agricultural Service Bulletin 152, 13-24.
- Kader, A.A., ed. 2002. Post-harvest technology of horticultural crops. Oakland: University of California, Division of Agriculture and Natural Resources Publication 3311, 535 pp.

- Kaiser, H. F. (1960). The Application of Electronic Computers to Factor Analysis. Educational and Psychological Measurement, 20, 141-151.
- Katz, M. H. (1999). *Multivariable analysis: A practical guide for clinicians*. Cambridge: Cambridge University Press.
- Kaynak, E. (1986). Food Marketing System: Less Developed Countries Practices, Journal of Food Marketing, 21-37.
- Kereth, G. A., Lyimo, M., Mbwana, H. A., Mongi, R. J., & Ruhembe, C. C. (2013). Assessment of Post-harvest Handling Practices : Knowledge and Losses of Fruits in Bagamoyo District of Tanzania, 6088, 8–16.
- Kitinoja, L. and A.A. Kader. 2002. Small-scale post-harvest handling practices: A manual for horticultural crops. Fourth edition. Davis: University of California, Postharvest Horticulture Series 8E, 260 pp.
- Kitinoja, L. and J.R. Gorny. 1999. Post-harvest technology for small-scale produce marketers: Economic opportunities, quality and food safety. Davis: University of California, Postharvest Horticulture Series 21.
- Kitinoja, L., Saran, S., Roy, S. K., & Kader, A. a. (2011). Postharvest technology for developing countries: challenges and opportunities in research, outreach and advocacy. *Journal of the science of food and agriculture*, 91(4), 597–603.
- Kwadwo, A., Kristin, D., & Dejene, A. (2008). Advancing Agriculture in Developing Countries through Knowledge and Innovation. Retrieved from http://www.ifpri.org/sites/default/files/publications/oc59.pdf on 8 March 2014
- Lai, Y., Florkowski, W. J., Briickner, B., & Schonhof, I. (n.d.). Berlin Consumer Preferences for Quality Attributes of Fresh Vegetables.
- Lam, S.P. (1999). Predicting intentions to conserve water from the Theory of Planned Behavior, perceived moral obligation, and perceived water right. *Journal of Applied Social Psychology*, 29, 1058-1071.

- Liaghati, H., Veisi, H., Hematyar, H., & Ahmadzadeh, F. (2008). Assessing the student's attitudes towards sustainable agriculture. American. Eurasian Journal of Agricultural Environmental. Science, 3, 227-232.
- Luna-maldonado, A. I., Vigneault, C., & Nakaji, K. (2009).Postharvest Technologies of Fresh Horticulture Produce.
- Mad Nasir S. (2004), Infrastructure Issues: Implications for the Food and Agricultural System. Pacific Food System Outlook, 2004-2005. Pacific Economic Cooperation Council.
- Merican, Z. 2000. The role of government agencies in assessing HACCP- the Malaysian procedure. Food Control 11, 371-372.
- Ministry of Agriculture Malaysia (MOA), [Online] Available: <u>http://www.moa.gov.my/</u> [accessed 8th March 2012]
- M. S. Meena, Ashwani Kumar, K. M. Singh and H. R. Meena (2009). Farmers' Attitude Towards Post-Harvest Issues of Horticultural Crops. Indian J. Ext. Sci., 1 (1): 128-130.
- National Key Economic Areas Malaysia (NKEA), [Online] Available: <u>http://www.moa.gov.my/</u> [accessed 19th March 2012]
- Nik Fuad K., Syed Abdillah A. and Mukhtiar S., in Ali, M. (eds.) (2000). Dynamics of Vegetable Production, Distribution and Consumption in Asia. Asian Vegetable Research and Development Center.
- Ninth Malaysian Plan (9th MP) 2006-2010, [Online] Available: <u>www.epu.gov.my/en/ninth-malaysia-plan-2006-2010</u> [accessed 6th November 2011]
- Norsida Man, Fatimah Mohamed Arshad, Zainalabidin Mohamed, Mansor Ismail, Amin Mahir Abdullah, Ismail Abd. Latiff, Muhamad Fadzil Repin, Nolila Mohd. Nawi and Haron A. Rahim (2008). *Supply Chain Management of the Malaysian Fruits and Vegetables*, research report submitted to Federal Agricultural Marketing Authority, Malaysia, 85pp.

- Norusis, M.J. (1993). SPSS for Windows: Professional Statistics, Release 6.0.p. 47– 82.Chicago, IL: SPSS Inc.
- Olgyaiova, K., Pongrácz, E., Mikkola, T., Radoslav Skapa, R. & Keiski, R. L. (2005). Attitudes toward waste minimization in Finland and Czech republic -Barriers and drivers. In: Proceedings of the RESOPT closing seminar 'waste minimization and utilization in Oulu region: Drivers and constraints' Edited By Eva Pongrácz. Oulu University Press, Oulu. pp. 85 -109.
- Prokopy, L.S., Floress, K., Klotthor-Weinkauf, D. & Baumgart-Getz, A. (2008). Determinants of agricultural best management practice adoption: Evidence from the literature. *Journal of Soil and Water Conservation*, 63, 300-311.
- Rehman, T., McKemey, K., Yates, C. M., Cooke, R. J., Garforth, C. J., Tranter, R. B. et al. (2007).Identifying and understanding factors influencing the uptake of new technologies on dairy farms in SW England using the theory of reasoned action.*Agricultural Systems*, 94, 281-293.
- Rogers, E. M., & Quinlan, M. M. (2004). Diffusion of Innovations Everett M. Rogers, 1-25.
- Röling, N., & Van de Fliert, E. (1994). Transforming extension for sustainable agriculture: the case of integrated pest management in rice in Indonesia. Agriculture and Human Values, 11(2-3), 96-108.
- Rolle, R. S., & Ph, D. (2011). Role of Food Processing and Post-harvest Management in Improving Food and Nutrition Security in Cities v Urbanization and its impacts on food Urban Population in the Asia-Pacific Urbanization Trends in Asia, (November), 1–17.
- Shewfelt, R.L. and S.E. Prussia, eds. 1993. Post-harvest handling: A systems approach. San Diego, CA: Academic Press, 358 pp.
- Stuart, D. (2006). Reconciling Food Safety and Environmental Protection: A Literature Review First Edition October 2006 Reconciling Food Safety and Environmental Protection: A Literature Review First Edition, October 2006, (October).
- Tabachnick, B.G., and Fidell, L.S (2001). Using multivariate statistics (4th Edition). Boston, MA: Allyn & Bacon

Third National Agriculture Policy (NAP3 1998-2010)

- Thompson, A.K. (1996). *Post-harvest technology of fruits and vegetables*. Oxford: Blackwell Science, 410 pp.
- Thompson, A.K. (1998). *Controlled atmosphere storage of fruits and vegetables*. Wallingford, UK: CAB International, 288 pp.
- Thompson, J.F., P.E. Brecht, R.T. Hinsch, and A.A. Kader, (2000).Marine container transport of chilled perishable produce. Oakland: Univ. Calif. Div. Agric. and Nat. Res. Publ. 21595, 32 pp. Uttarakhand, V. (2011). Economic Analysis of Post-harvest Losses in Marketing of, 24(December), 309-315.
- van Gossum, P., Luyddsert, S., Serbruyns, I., & Mortier, F. (2005). Forest groups as support to private forest owners in developing close-to-nature management. *Forest Policy and Economics*, 7, 589-601.
- Verma, A. & Seth, N. (2001). Conceptual Framework for Supply Chain Competitiveness. International Journal of Human and Social Science, 6(1), 5-10.
- Wauters, E., Bielders, C., Poesen, J., Govers, G. & Mathijs, E. (2010). Adoption of soil conservation practices in Belgium: An examination of the theory of planned behaviour in the agri-environmental domain. *Land Use Policy*, 27, 86-94.
- Wills, R., B. McGlasson, D. Graham, and D. Joyce. (1998). Postharvest: An Introduction to the Physiology and Handling of Fruit, Vegetables and Ornamentals. 4th ed. CAB International, Wallingford, Oxon, UK.262 pp.

Wilson, T. D. (1998). Multiple attitudes. Unpublished Manuscript. University of Virginia.

Wilson, L.G., M.D. Boyette, and E.A. Estes.(1995). Postharvest Handling and Cooling ofFresh Fruits, Vegetables and Flowers for Small Farms.Leaflets 800–804.North CarolinaCooperative Extension Service.17 p. Accessed on-line at:http://www.foodsafety.org/nc/nc1055.htm Wojciech J. Florkowski, Robert L. Shewfelt, Bernhard Brueckner, 2009. Challenges in Postharvest Handling. *Post-harvest handling: A systems approach* (2nd Edition). pp. 583-588

