UNIVERSITI PUTRA MALAYSIA

USE OF INFORMATION AND COMMUNICATION TECHNOLOGY IN PRODUCTION AND MARKETING AMONG VEGETABLE FARMERS IN PENINSULAR MALAYSIA

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By

NOR HASLINA BINTI NOR RIZAN

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

October 2017

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DEDICATION

The thesis is dedicated to my beloved ones

My husband

&

My Kids

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

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By

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October 2017

Chairman : Associate Professor Amin Mahir bin Abdullah, PhD
Faculty : Agriculture

The development and widespread usage of information and communication technologies (ICT) become more important especially in the knowledge economy to ensure the realisation of Vision 2020. The diffusion of ICT services serves the social and economic development of the country. The state of this industry spells out the viability for investors to invest in Malaysia. ICT usage has improved efficiencies among Malaysia enterprises and directly increased Malaysia's competitiveness in the global economy. Majorityof economists agree that information and communication technologies explain a significant share of productivity gains in modern economic. The development of ICT, especially in gadgets and mobile applications has expanded exponentially.Hence, we can see nobody in the country from children to edults leave home without a gadget. This development is being observed among farm producers either for personal uses as well as in their production.

This research attempts to identify the current levels of ICT that farmers use in production and marketing of vegetables, to determine a factor influencing the use of ICT among vegetable farmers, to evaluate the ICT contributions toward production and marketing of vegetables and to determine the socio economic variable influencing ICT use among vegetables farmers. This research employed modified Technology Acceptance Model (TAM) in an attempt to assess Malaysian vegetable farmers' attitudes toward ICT usage. Face to face interviews was conducted with 300 farmers using a standard structured questionnaire. Descriptive, factor analysis and regression analyses were employed to obtain the required results and objectives.

The average farmers' age is 41 years old while average of farm size is 2.0 hectares. The mean farming experience is 12.67 and the ICT use per day is 96 minutes. The majority of farmers have education up to secondary school. Most used ICT tools by vegetable farmers are hand phones, smartphones, fixed line, tablet, computer, and fax machine. They are used to get agriculture information and sharing knowledge with others. Perceived usefulness, perceived ease of use, subjective norm and facilitating condition have a positive effect on the attitude of farmers to used ICT. In order to increase ICT usage and encourage farmers to applied ICT, agencies or related departments should provide them with training in ICT related courses. The relevant departments should also facilitate access to information through mobile phones applications such as WhatsApp, Facebook or other social media. Other agencies should look at this upgrade the coverage access at this area so that farmers can use the phone and the internet to make a call or search for information from other farmers, supplier easier or websites in their field.

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

PENGGUNAAN TEKNOLOGI MAKLUMAT DAN KOMUNIKASI DALAM PENGELUARAN DAN PEMASARAN HASIL PERTANIAN DI KALANGAN PETANI SAYUR-SAYURAN DI SEMENANJUNG MALAYSIA

Oleh

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Pembangunan dan penggunaan yang meluas terhadap teknologi maklumat dan komunikasi (ICT) adalah penting terutama pengetahuan dalam bidang ekonomi bagi merealisasikan Wawasan 2020. ICT menjadi penyebar maklumat dalam pembangunan sosial dan ekonomi di negara ini. Keadaan semasa industry ini menunjukkan daya maju untuk pelabur asing melabur di Malaysia. Penggunaan ICT telah meningkatkan kecekapan perusahaan di Malaysia sekaligus meningkatkan daya saing Malaysia dalam ekonomi global. Majorit ahli ekonomi bersetuju bahawa teknologi maklumat dan komunikasi menjelaskan perbezaan yang ketara dalam peningkatan produktiviti bagi ekonomi moden dewasa ini. Pembangunan ICT terutama dalam peralatan dan aplikasi mudah alih sangat berkembang dengan pesat di negara ini. Hal ini dapat dilihat di negara ini samaada dari kalangan kanak – kanak hinggalah orang dewasa yang mana mereka tidak akan meninggalkan rumah tanpa gadget Perkembangan ini juga sedang dipraktikkan oleh petani sama ada untuk kegunaan peribadi dan juga dalam pengeluaran produk mereka.

Kajian ini bertujuan untuk mengenal pasti tahap penggunaan semasa ICT dikalangan petani dalam pengeluaran dan pemasaran sayur-sayuran,menentukan faktor yang mempengaruhi penggunaan ICT di kalangan petani sayur-sayuran,menilai sumbangan ICT ke arah pengeluaran dan pemasaran sayur-sayuran dan menentukan sosio ekonomi petani yang mempengaruhi dan mengubah penggunaan ICT di kalangan petani. Penyelidikan ini menggunakan adaptasi dari Model Penerimaan Teknologi (TAM) dalam usaha untuk menilai sikap petani sayur-sayuran Malaysia ke arah penggunaan ICT. Temubual secara bersemuka telah dijalankan ke atas 300 petani

menggunakan soal selidik berstruktur. Analisis deskriptif, faktor, chi-square dan regresi telah digunakan untuk mendapatkan hasil dan objektif yang diperlukan.

Purata umur petani adalah 41 tahun manakala purata saiz ladang adalah 2.0 hektar. Purata pengalaman petani dalam pertanian adalah 12.67 dan penggunaan ICT sehari ialah 96 minit. Majoriti petani mempunyai pendidikan sekolah menengah. Kebanyakan alat ICT yang digunakan oleh petani sayur-sayuran adalah telefon bimbit, telefon pintar, talian tetap, tablet, komputer dan mesin faks. Ia digunakan untuk mendapatkan maklumat pertanian, dan perkongsian pengetahuan dengan orang lain. Pegunaan yang dilihat, peggunaan yang mudah dilihat, norma subjektif dan keadaan yang memudahkan penggunaan mempunyai kesan positif ke atas sikap petani untuk menggunakan ICT.

Dalam usaha untuk meningkatkan penggunaan ICT dan menggalakkan petani untuk menggunakan ICT, agensi atau jabatan yang berkaitan perlu menyediakan latihan berkaita ICT. Jabatan-jabatan yang berkaitan juga perlu menyediakan kemudahan untuk petani bagi mengakses maklumat melalui telefon, aplikasi mudah alih seperti WhatsApp, Facebook atau media sosial yang lain. Selain itu, agensi-agensi lain harus menaik taraf akses liputan di kawasan petanian bagi memudahkan petani untuk menggunakan telefon dan internet bagi membuat panggilan atau mencari maklumat antara petani lain, mencari pembekal dengan lebih mudah atau ,mengakses laman web dari ladang mereka.

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This thesis was 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:

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LIST OF ABBREVIATIONS

10th MP	Tenth Malaysia Plan
9th MP	Ninth Malaysia Plan
DOA	Department of Agriculture
DP	Dependent Variable
ETAM	Extended Technology Accceptance Model
FAO	Food and Agriculture Organization
GDP	Gross domestic product
GNI	Gross National Income
ICT	Information Communication Technology
IDI	ICT Development Index
KMO	Keiser Meiyer Olkin
LPP	Lembaga Pertubuhan Peladang
MCMC	Malaysia Communication Multimedia Commission
MOA	Ministry of Agriculture and Agro-based Industry
MPOB	Malaysian Palm Oil Board
MyIX	Malaysia Internet Exchange
NAP	National Agricultural Plan
NBI	National Broadband Initiative
NITA	National Information and Technology Agenda
NRI	Network Readiness Index
PCA	Principal Component Analysis
POIC	Palm Oil Industrial Clusters
RISDA	Rubber Industry Smallholders Development Authority

SCT	Social cognitive Theory
SMEs	Small and medium enterprises
SPSS	Statistical Package For The Socaial Sciences
TAM	Technology Acceptance Model
TII	Telecommunication Infrastructure Index
TPB	Theory of Planned Behavior
TRA	Theory of Reasoned Action
UTAUT	Unified Theory of Acceptance and Use of Technology

CHAPTER 1

INTRODUCTION

This chapter focuses on the background of the study, agricultural sector in Malaysia, an overview of the vegetable industry and the use of ICT in Malaysia. This chapter also brief about problem statement, research questions, and objectives of the study and the significance of the study.

1.1 Background of Study

ICT usage is becoming increasingly important in people's daily lives, to the extent that ICT is the spine of most business activities, productivity, trade and social development. The effectiveness implementation of ICT policies is a precondition to the emergence of a tough market economy. The growth of industries and enhancement of social activities are not only dependent on adequate skilled labours but also effective implementation of ICT policies.

In connection with the impressive growth in ICT infrastructure and uptake during the past decade has led to an increasing demand for accurate and comparable data and statistics on ICT. Almost 8.34% (2.6 million) from Malaysia population (31.19 million) has subscript broadband. In line, 6.2 million households in Malaysia, 31.7% household has subscript the broadband, and 16.0 million are internet users. Data from a survey by Malaysia Communication Multimedia Commission (MCMC) shows that 94.2 % individuals use mobile phones in Malaysia, 56.0% individual use computers, a computer refer to the desktop, laptop and tablet. Fifty-seven percent (57%) individuals use the internet via mobile phone, PDAs, game machines, TV digital, fixed lines network and mobile phone. Around 60.3% individual in Malaysia used the internet at least once a day and 2.8% individual used the internet less than once a month. Most of them used the internet for posting information or instant message, to sending or receiving email, getting information about good and services, downloading i.e. movies, images, music, watching TV or video, or listening to radio or music and lastly for reading or downloading online i.e. newspapers or magazines, and electronic books.

Table 1.1 : ICT used in Malaysia

Broadband	Total broadband subscriptions	298 million
	Total households broadband subscription	5.8 million
	Broadband penetration rate per 100 households	76.7%
	Total fixed broadband subscription	2.7 million
	Total mobile broadband subscriptions	27.1 million
Fixed telephones	Total fixed lines subscriptions	4.6 million
	Fixed line penetration rate per 100 inhabitants	14.7%
Mobile 4cellular telephones	Total mobile cellular telephones subscriptions	43.5 million
	Mobile cellular telephones penetration rate per 100 inhabitants	140.9%
	Post-paid subscriptions	9.2 millions
	Prepaid subscriptions	34.3 millions

Source: Malaysia Communications and Multimedia Commission (2016)

Table 1.2 : Malaysia ranking for ICT

Year	ICT Development Index	E-Government Development Index (EGD)	Networked Readiness Index (NRI)
2015	66	….	32
2016	61	60	31

Source: Malaysia Communications and Multimedia Commission (2016)

Table 1.1 and 1.2 show the ICT Development Index (IDI).This index captures the level of advancement of ICTs, measures the global digital divide and examines how it has developed in recent years. The International Telecommunication Union produces this index,while the E-Government Development Index presents the state of E-Government Development of the United Nations Member States. One of the components in EGDI is Telecommunication Infrastructure Index (TII), in which Malaysia ranks 70 in 2016. This index is published by the UN Public Administration Network every two years. Lastly is Network Readiness Index (NRI) was measures the propensity for countries to exploit the opportunities offered by ICT. The index has been compiled for 139 economies by World Economic Forum.

Nowadays the development of information technology is booming at the momentand benefited into all aspects of human life, including education, banking, medicine, agriculture, and so forth. As far as agriculture is concerned, E-Agriculture involves the conceptualization, design, development, evaluation and application of innovative ways to use information and communication technology (ICT) in the rural domain, with a primary focus on agricultural production, marketing and trade. This is true regarding modernization of agriculture such as precision agriculture in production, and market information that helps both producers and consumer to make production

and purchase decisions. The agricultural sector experienced some problems, which are caused by the narrowing of land for agriculture, the limited capital for business, the lack of use of information technology and the difficulty of marketing. It could lead to a slower response to the market requirements and hence losing competitiveness. Therefore, government is trying to take advantage of ICT to accelerate development in the agricultural sector. The use of ICT in the agricultural sector is what we often refer to as e-Agriculture or e-Agribusiness.

Word e in e-Agriculture or e-Agribusiness means electronic. E-Agriculture or e-Agribusiness are refer to ICT use in agriculture and agribusiness using computers, internet, software (software) and hardware (hardware), radio, television and other IT devices, as well as the people who operate these ICT. E-Agriculture applications or e-Agribusiness can be use in all activities ranging from agricultural activities in the upstream (production) to the downstream (marketing).

The Department of Agriculture (DOA) has begun to use ICT in network activities, publications, databases and web creation. Alternatively, in other words, e- Agriculture is a field with focus on the improvement of agriculture sector and rural development through information and communication processes.

1.2 Agricultural Sector in Malaysia

Agriculture in Malaysia particularly agrifood sector is often characterised by a dualism that is the smallholders and plantation production structure. However agro-food production is dominated by the small scale producers. The statistics on agricultural land use recorded by the Ministry of Agriculture and Agro-based Industry (MOA) indicate that agricultural land use, the cultivated area for vegetable is about 80 707 ha. Agricultural land states to the part of land area either permanent crops or permanent pastures. In line, temporary crops, temporary meadows for mowing or pasture, land under market , urban agricluture, and land temporarily fallow are included as agriculture land. Permanent crops land is refer to land cultivated such as TKPM, of time and need not be replanted after each harvest. This land also includes land under flowering shrubs, fruit trees, nut trees, and vines, but excludes trees grown for wood or timber. Permanent pasture is a land used for forage about five or more years, including natural and cultivated crops.

The agricultural sector has recorded impressive growth in The Eight Malaysian Plan (RMKe-8). The returns from this division have soared due to increase in exports and prices for agricultural products. This sector continuously provides raw materials to the local Agri-based industries and also makes practically half of the country's food necessity. In the bout of The Ninth Malaysian Plan (RMke-9), the agricultural section is further strengthened in sequence to sustain the position as the third economic engine for the economy growth. Therefore, a number of strategies are addressed to achieve above objective included generating agricultural production on a large scale, uses of

technology, encouraging agricultural methods using ICT and produce agriculture experts (The Ninth Malaysian Plan, 2006-2010)

The average Gross Domestic Product (GDP) of Agriculture value added from 2010 to 2015 was around RM 2.25 billion. In 2015, The GDP of agriculture recorded all time high at RM2.67 billion in the third quarter but slid down to RM 2.35 billion in the fourth quarter (Department of Statistics Malaysia, 2016).

The Ninth Malaysia Plan (9th MP) was formulated for the period from 2006 – 2010, with the objective to upgrade the manufacturing sector into higher value added activity and strengthen the related services. The focus was on altering SMEs as an industrial business into a knowledge based and value generating entities. The application of technology and innovation was emphasised to support the strategies. The 9th MP also aimed to increase Malaysia's self-sufficiency level of several crops and livestock to lessen its dependence on imports, especially imported food products. To accomplish that objective, the government planned to intensify agro – based processing activities and product diversification to promote Malaysia's products at international level. In order to achieve this, a strategy was made to boost up agricultural production as the supplier of raw materials to food manufacturing sector. The Tenth Malaysia Plan (10th MP) formulated in 2011 – 2015, was designed with consideration of Malaysia's New Economic Model approach (NEM). The NEM is an economic plan developed by the Malaysian Prime Minister with the intent to double per capita income of Malaysian. The NEM model uses three main elements namely high income, sustainability and inclusiveness to accelerate compensate the slow development observed under the Ninth Malaysia Plan (9th MP) period. The 10th MP put forward the private sector as an engine to accelerate economic growth. The 10th MP targets the increase GDP to RM 21.9 billion and the gross national income (GNI) per capita to RM 38, 850 or USD 12,140 by 2015. Consequently, Malaysia needs to attain a real GDP growth of 6 % annually. The services and manufacturing sector are expected to spur the growth.

1.3 Vegetable Industry in Malaysia

The vegetable industry is best described as an industry with a various group of crops. The DOA reports stated over 50 separate vegetables (categorised either as leaves, fruit, root etc.) or cash crops (cassava, groundnuts, maize, yam and sweet potatoes) and spices (ginger, hot chilli, lemon grass etc.) are cultivated in Malaysia. Most vegetables are annuals (e.g.Tomatoes, and potatoes), while others are biennials (e.g. Asparagus). Most of the vegetable are grown for direct consumption for fresh market, while some are grown for processing products such as tomato sauce. Many vegetables require similar handling and share a common marketing system. Wholesale markets, for examples, handle most types of vegetables. Fresh produce is highly perishable and requires a quick turnaround between farm and market and preferably cooling during storage and transportation. The perishability of fresh produce also dictates special handling to minimise post-harvest marketing losses. Although the majority of vegetables are consumed directly e.g fresh rather while raw materials used at the

manufacture to produce sauces and pickles. Local demand for vegetables is expected to increase from 1.6 million tonnes in 2010 to 2.4 million tonnes in 2020, with a growth of 4.5% per annum. In line with the trend in developing countries, per capita, vegetable consumption is expected to grow by 2.6% per annum, from 55 to 70 kilograms per year kilograms in the same period. Vegetable production is projected to increase from 0.7 million tonnes to 1.7 million tonnes with a growth rate of 9.8% per annum. The expected increase in production was mainly due to productivity improvement and the expansion of new areas of cultivation of vegetables such as spinach, mustard leaves, cucumber, spinach and others.

Table 1.3 : Hectare, production and value of production of vegetables, Malaysia, 2015

Types of vegetables	Planted area (Ha)	Harvested area (Ha)	Production (Mt)	Value of production (RM '000)	Average production (Mt/ Ha)
Asparagus (*Asparagus officinalis*)	11.9	11.9	68.5	-	5.8
Bayam (*Amaranthus gangeticus*)	3,946.8	3,859.5	48,356.6	71,729.0	12.5
Bendi (*Abelmoschus esculentus*)	3550.1	3,325.7	50,777.9	162,489.2	15.3
Brokoli (*Brassica oleracea var. italica*)	189.2	189.2	1,626.6	6,181.0	8.6
Cili (*Capsicum spp.*)	3103.9	2,915.0	47,015.1	281,307.3	16.1
Cili Padi (*Capsicum annum*	463.3	411.1	1,978.7	28,592.5	4.8
Cekur Manis (*Sauropus androgynus*)	386.1	327.4	4,899.9	12,984.8	15.0
Daun Bawang (*Allium cepa*)	484.0	479.8	7,864.1	33,422.4	16.4
Daun Saderi (*Apium graveolens*)	660.8	654.7	17,494.4	88,346.6	26.7
Daun Ketumbar (*Coriandrum sativum*)	207.5	207.5	2,158.7	13,816.0	10.4
Jagung Sayur (*Zea mays*)	89.1	88.2	591.2	1,507.7	6.7
Kailan (*Brassica oleracea*)	1421.4	1,366.6	17,471.2	51,540.0	12.8
Kangkung (*Ipomoea reptans*)	4018.9	3,947.6	45,286.6	63,401.2	11.5
Kobis Bulat (*Brassica oleracea var. sabellica*)	8719.7	8,260.9	277,202.2	401,943.2	33.6
Kobis Cina (*Brassica rapa subsp. pekinensis*)	209.6	196.5	2,417.1	7,492.9	12.3
Kucai (*Allium tuberosum*)	368.9	356.1	4,571.6	23,086.7	12.8
Kacang Botol (*Psophocarpus tetragonolobus*)	1182.4	1,161.4	15,341.7	65,202.1	13.2
Kacang Buncis (*Phaseolus vulgaris*)	4799.0	4,306.6	69,294.7	162,842.5	16.1
Kacang Panjang (*Vigna unguiculata ssp. sesquipedalis*)	149.0	137.0	2,067.2	2,739.0	15.1
Kundur (*Benincasa hispida*)	283.8	283.8	3,833.6	-	13.5
Kacang Pea (*Pisum sativum var. saccharatum*)	86.3	86.3	799.3	-	-
	-	30.0	-	-	-
	30.0	216.0	1,140.0	-	-
	216.0		9,858.6	22,967.8	45.6
	622.3	622.3	6,292.6	8,813.1	10.1
	556.4	519.2	7,344.2	34,629.8	14.1
	1973.3	1,817.1	25,651.7	-	14.1

Kacang Serinding (*Phaseolus*	208.6	208.6	3,335.6	11,362.5	16.0
lunatus)	306.2	306.2	7,836.2	50,235.3	25.6
Kacang Wangi (*Lathyrus odoratus*)	158.9	158.9	7,042.3	-	44.3
Kincam (Lily Bud)	36.5	36.5	695.4	-	19.0
Kaukei (*Lycium barbarum*)	172.8	172.8	4,061.3	-	-
Kobis Bunga (*Brassica oleracea var.*	19.5	17.7	176.9		10.0
botrytis)	13.2	13.2	86.0	386.9	6.5
Labu Air (*Lagenaria siceraria*)	1312.0	1,218.3	19,660.3	42,269.7	16.1
Labu Manis (*Cucurbita pepo n)*	103.5	81.4	1,250.8	3,439.8	
Lobak Merah (*Daucus carota subsp.*	1419.2	1,314.7	20,448.1	34,761.7	
sativus)	118.3	114.6	1,996.2	3,293.8	
Lobak Putih (*Raphanus sativus var.*	165.7	165.7	1,743.5	7,061.0	10.5
Longipinnatus)	48.1	42.0	429.8	1,332.5	10.2
Lada Besar (*Capsicum annuum*)	18.3	17.7	201.3	-	11.4
Labu Siam (*Sechium edule*)	6.2	6.2	6.2	18.6	1.0
Lekoi (*Allium ampeloprasum L*)	21.7	20.9	75.7	227.2	3.6
Maman (*Cleome gynandra*)	10.4	10.4	160.6	-	15.4
Meranti (*Hopea sulcata*)	3195.2	3,182.3	66,006.0	240,921.7	20.7
Peria (*Momordica charantia*)	12493.4		216,353.4	499,776.3	16.4
Peria Katak (*Momordica charantia*)	149.3	13,190.5	1,354.5	4,063.4	9.1
Petola Segi (*Luffa acutangula*)	1.4	149.3	4.7	-	3.3
Petola Ular (*Trichosanthes*	235.0	1.4	3,290.0	-	14.0
cucumerina)	2398.8	235.0	50,223.6	135,603.7	22.3
Poh Choy (Chiness Spinach)	4738.0	2,254.4	100,816.9	115,939.4	23.1
Pucuk Paku (Fern Shoot)	1999.5	4,371.4	165,176.6	359,259.2	83.2
Pucuk Keledek (Pucuk Keledek)	39.2	1,984.4	1293.6	-	33.0
Rebung Buluh (Bamboo Shout	39.2	39.2 39	640.0	-	16.3
Rebung Madu (Bamboo Shout	58.9	58.8	2929.7	-	49.9
Remayong(*Salacca magnifica*)					
Salad (*Lactuca sativa*)					
Sawi (*Brassica oleracea*)					
Selada Air (*Nasturtium officinale*)					

Taugeh (*Vigna radiata*) Tong Ho (*Chrysanthemum spp*.) Terung (*Solanum melongena*) Timun (*Cucumis sativus*) Tomato (*Solanum lycopersicum* Tomato) Ubi Bit (*Beta vulgaris*) Yau Mak (*Lactuca sativa)* Zukini (*Cucurbita pepo var. cylindrica*)					
JUMLAH (TOTAL)	**68,926.8**	**65,899.3**	**1,373,086.4**	**3,054,987.6**	**20.8**

(Source: Vegetables and Cash Crop Statistic Malaysia, DOA, 2015)

Table 1.4 : Hectarge, production and value of production of vegetables, Malaysia 2015

Country	Planted area (Ha)	Harvested area (Ha)	Production (Mt)	Value of production (RM '000)
Malaysia	89,492.21	84,5433.10	1,600,548.29	3,406,865.66

Table 1.5 : Agro food production forecast 2011- 2020 ('000mt)

Item	2010	2015	2020	CAGR (%) 2011 - 2020
Crop	4060	4930	6102	4.16
Rice	1642	1785	1875	1.34
Fruits	1768	2115	1875	3.81
Vegetables	651	1029	1658	9.80

(Source: NAP 2011- 2020)

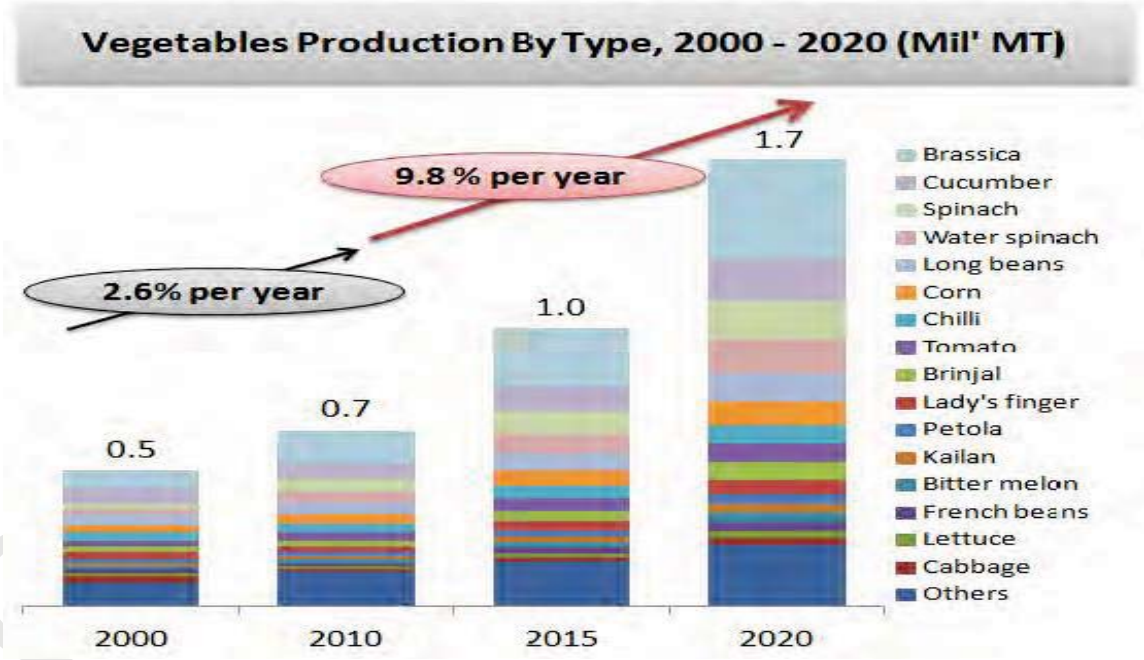

Figure 1.1 : Vegetable production by type
(Source: NAP 2011- 2020)

Intensity level = 1.8 - 2.5 cycles per year (fertigation, precision farming, Home Protector Rain). An additional area of 8,000 ha; Permanent Food Production Park, vacant land, cluster projects, organic farming & crop integration. Products - organic vegetable products

Vegetables have always been important cash crops cultivated by farmers, particularly in areas surrounding large urban centres. Besides, there are vegetable farmers who have ventured out to become commercial vegetable producers and exporters. Vegetable production has at present expanded vastly and employs highly sophisticated techniques that increase productivity and quality of the produce.

This transformation was possible due to the incorporation of the latest technology and techniques such as planting of vegetables under controlled environment in netted structures, rain shelters, and structures with automatically controlled fertigation and controlled lighting. The utilisation of state- of – art technology and techniques make it possible for vegetable producers to produce varied vegetable types in abundance, including many temperate varieties that would not have been possible 40 years ago. Vegetable production has also improved tremendously because of the highly efficient and profitable endeavours undertaken by local farmers who cater for both the local and export market, especially Singapore.

1.4 ICT in Malaysia

The development and widespread usage of ICT are central to the realisation of Vision 2020 of knowledge- based economy. The diffusion of ICT services serves the social and economic development of the country. The state of the industry also spells out the viability to invest in Malaysia. ICT usage has improved efficiencies among Malaysia enterprise and has also directly increased Malaysia's competitiveness in the global economy. Many economists agree that ICT explains a significant share of productivity gains in modern economies. In developed nations such as the United States, the development of ICT has provided the platform for the resurgence of growth of her economy in the past ten years.

The Malaysian ICT industry continuing grows positively year by year for the past decade and ICT spending around RM40.48billion in 2006. In 2007, ICT spending was expected to total at almost RM 43.43 billion, a 7.2 % growth from the previous year. ICT spending will continue to grow at a compounded annual growth rate of 7.5 % in the forecast period between 2005 and 2010. In 2010, the ICT spending was expected to hit a high of RM53.47billion.

The strength of the industry is often reflected by the quality of human resource, research and development as well as the funding environment. In 2005, there was a total of 364,656 people employed within the IT industry in Malaysia. This figure is expected to reach almost half a million people by 2010. While the growth in quantity is essential, various programmes are in place to ensure that the workers are of the highest standards. The number of R&D projects is on the rise with more than 6,300 undertaken by government agencies and research institutes, institutions of higher learning, and the private sector. The venture capital market was worth over RM 2.5 billion with an investment of RM 1.44 billion.

The government has played a proactive role in increasing the connectivity diffusion in term of infrastructure, via cellular and internet, and introduced a variety of programmes including the Malaysian Internet Exchange (MyIX) to ensure that a critical mass of user is achieved as soon as possible in order to create innovation on a wider global scale.

The government is also aggressively stepping up its efforts to ensure the creation of a roadmap for the next generation infrastructure. This would, in return, increase commercialisation and gains within the industry. Government organisations have been restructured to increase focus in facilitating policies for the ICT industry. New areas of governance include supporting applied research, security and ramping up local domain registrations.

Technology is considered one of the most important factors in gaining competitive advantage and to succeed in this competitive era of globalisation. It helps for faster production and decision-making. March and Sproull (1990) reported that competition is one of the leading factors that make organisations exploit new and superior technologies (Aafaqi et al., 2007).

The majority of Malaysian nowadays have own ICT tools. This is fine on the recent statistics from the Malaysian Communications and Multimedia Commission (MCMC), there are more than 13 million mobile phone subscribers over the country, with the penetration rate now striking 50 % while more than 84 million SMS were address every day (Llyod, 2005). As stated by a local newspaper report, Utusan Melayu (2008), about 500,000 of Malaysian blogs were developed meanwhile apart from half million people in Malaysia have connection to the internet in 2006. This matter shows that millions of Malaysian capable to own the ICT tools (Hassan et al., 2008).

ICT in agriculture is gaining ground. As in other sectors, ICT improves production, transaction and marketing of the outputs. It is observed that ICT use among agriculture producers and marketers are becoming popular. The use of ICT facilitates communication at lower cost and hence improves both economic and technical efficiency. The DOA has been involved in many innovations in recent times. However it is recognised that some agricultural methods and workers are so steeped in tradition that change has not always been easy.

The use of ICT is now being encouraged in the Malaysia agricultural sector to become more competitive. This is understandable because of the roles of ICT often stand out, whether it is in the course of production technology and information technology activities. It is hoped that the agribusiness in Malaysia would adopt ICT as technology will improve efficiency and hence, future Malaysian agriculture will be more responsive to market needs such as better product quality and safety.

The ICT delivers enormous opportunities in increasing effectiveness through the internet, communications and the hasty distribution and acquiring information to worldwide everytime (Jung, 2001). The opportunities offered by ICT have to be taken carefully due to the probable welfare provided. It is unwise to expose ICT just for urban community without bringing together to the rural community. The government has introduced the National Broadband Initiative (NBI) to encourage the farmers to become ICT literate.

The National Agro–Food Policy primarily stated the issues of the food supply in Malaysia based on consumer's need e.g. quality, safety, nutrition, functionality, and environmental sustainability. The policy also targets to make agro–food industry as a competitive and sustainable industry with increases of agro-based entrepreneur's level of income. The aims of the policy follow the strategic directions as ensure national

food security, increase the contribution of agro–food industry, completing the value – chain, empowering human capital, creating the environment for private sectors- led business, strengthen the activities of R& D, innovation and the use of technology and strengthening the delivery system.

1.5 Problem Statement

The development of ICT usage is basically running parallel with a nation's economic development. As a developed country, demand for information and communication for both businesses and individuals growing fast and increasing. In line, knowledge sharing becomes more necessary everyday. Malaysia is a dynamic country with fastest internet usage penetration in Asia . Large businesses certainly have to improve ICT usage in their operational to increase efficiency and save costs particularly transaction cost. In Malaysia, ICT development has been toughened by the National Information and Technology Agenda (NITA) and Universal Services Provider (USP). Despite impressive ICT progress, there are segments of population lagged behind in its applications.

Information and communication have always mattered in agriculture. Ever since people have grown crops, raised livestock, and caught fish, they have sought information from one another. They need to search updated information for effective planting strategy, improvement of seed or feed, price and market, government intervention program, financial assistant and anothers related information to agriculture. Updated information allows farmers to cope with and even benefit from these changes.

In Malaysia, growing population is only one reason agriculture is critical to fulfil food security, safety and siverginity. It is also critical because one of the most effective ways of reducing poverty is to invest in and make improvements in the agricultural sector. In line, vegetable is one of the food crop need to give more intention to increase production. Smallholder's vegetable farmers and dwelling in rural areas are poor especially for access to agricultural production and marketing information services. Hence, linking these farmers to markets become a major challenges. These challenges may result of poor connectivity, ICT illiterate and unavailable of info-structure. Therefore, the arrival of ICT is well timed. ICT is one of these solutions, and has recently unleashed incredible potential to improve agriculture in developing countries specifically. Nevertheless, it is observed that the use of the internet, mobile phones, tablets and smart phones have gained ground among younger ,higher educated generation and commercial farmers. Consequently, as responsible agency, DOA takes this challenge to improve and increase vegetable production and marketing by using ICT.

The benefits of ICT use by farmers in their farming operation are numerous included a reduction in transaction cost, reduction in costs of information exchange, spurs commercialization which subsequently improve the welfare and livelihood of the farming communities. The availability of market intelligence enables farmers to check receive and the prevailing market prices. Besides, internet networks assist farmers to access information related to vegetable supply, weather, training course etc. A more progressive farmer will develop a website, instagram business, facebook page etc. as a platform to advertise and market thier product

Based on the above scenario and benefits of ICT, this research attempts to investigate the use of ICT among vegetable farmers in Peninsular Malaysia. This research need to answers the following research questions:-

1. What are the current levels of ICT that farmers use in production and marketing of vegetables?
2. What are the relationship between ICT use, farm characteristics and demographic factors?
3. What are the factors influencing the use of ICT among vegetable farmers?
4. What are the most influential factors influencing ICT use among vegetable farmers?

1.6 Objectives of the Study

The general objective of this study is to investigate the use ICT in production and marketing of vegetables by farmers in the Peninsular Malaysia. The specific objectives of this study are:

1) To identify the current levels of ICT that farmers use in production and marketing of vegetables
2) To determine the relationship between ICT use, farm characteristics and demographic factors.
3) To determine factors influencing attitude towards the use of ICT among vegetable farmers
4) To determine the socio economic variable influencing ICT use among vegetable farmers.

1.7 Significance of the Study

This study is significant because it can provide new knowledge mainly in ICT used among the vegetable farmers in Peninsular Malaysia. The information of current ICT used may lead to increase further study for other farmers in Malaysia. Besides that, this study would be favored to those aspire to conduct further and a deeper study in this area. This study provide about the vegetable farmers specifically the ICT usage, type of ICT that Malaysia vegetable farmers used and the factors influencing them to

use the ICT in their production. Additionally, through this study, the target groups of the future ICT program can be determine through the descriptive analysis of farmers' demographic profile.

The evaluation of ICT use among vegetable farmers is justifiable as the efforts of the government are too narrow down digital divide of Malaysian which contributes the nation's economic development. More importantly, the final analysis helps policy makers formulate appropriate interventions to promote ICT use among agricultural producers who eventually improve small scale farmers' livelihood and good quality product. The result of this study can be specified by the policy makers specifically DOA in evaluating the results of their technology contribution in ICT. The result collected on the level of running of ICT between the vegetable farmers reflects to the objectives of ICT investment by the government.

REFERENCES

Aafaqi, B., Jantan, M., & Ramayah, T. (2007). Validity of the technology acceptance model (tam): a sensemaking perspective. *Ijms*, *14*(1), 99–120.

Abdullah, A. M., Ramli, M. F., & Sood, A. M. (2013). Agricultural Land Use In Malaysia : An Historical Overview And Implications For Food Security, *19*(1), 60–69.

Abu-Dalbouh, H. M. (2013). A questionnaire approach based on the technology acceptance model for mobile tracking on patient progress applications. *Journal of Computer Science*, *9*(6), 763–770. http://doi.org/10.3844/jcssp.2013.763.770

Ajani, E. (2010). Constraints to Effective Use of Information Communication Technologies (ICTs) among Small-scale Farmers in.

Behera, B. S., Panda, B., Behera, R. A., Nayak, N., Behera, A. C., & Jena, S. (2015). Information Communication Technology Promoting Retail Marketing in Agriculture Sector in India as a Study. *Procedia - Procedia Computer Science*, *48*(Iccc), 652–659. http://doi.org/10.1016/j.procs.2015.04.148

Davis, F. D., & Davis, B. F. D. (1989). Perceived Usefulness , Perceived Ease of Use , and User Acceptance of lnformation Technology, *13*(3), 319–340.

Davis, F. D., Davis, B. F. D., Morris, M. G., Hall, M., Davis, G. B., Davis, F. D., Surendran, P. (2016). Interventional factors affecting instructors adoption of e-learning system: A case study of palestine. *Working Papers on Information Systems*, *13*(3), 175–178. http://doi.org/10.1287/mnsc.46.2.186.11926

Dial “A” for agriculture_ a review of information and communication technologies for agricultural extension in developing countries. (2n.d.).

Echevarria, C. (1998). a Three-Factor Agricultural Production Function: the Case of Canada. *International Economic Journal*, *12*(3), 63–75. http://doi.org/10.1080/10168739800080022

Ejiofor, T. (2009). Application of information and communication technology (ICT) in agricultural production in Aguata agricultural Zone of Anambra State: Constraints and enhancement measures. *Journal of Home Economics Research*, *10-11*, 125–134.

Ekuobase, G. O., & Olutayo, V. A. (2016). Study of Information and Communication Technology (ICT) maturity and value : The relationship. *Egyptian Informatics*

Journal. http://doi.org/10.1016/j.eij.2015.12.001

Flowers, S. K., Vanderbush, R. E., Hastings, J. K., & West, D. (2010). Web-based multimedia vignettes in advanced community pharmacy practice experiences. *American Journal of Pharmaceutical Education*, *74*(3), 1–5. http://doi.org/10.5688/aj740339

Globinmed. (2014). Malaysia National Agro-Food Policy. Retrieved from http://www.globinmed.com/index.php?option=com_content&view=article&id=104378:malaysia-national-agro-food-policy&Itemid=321

Hamidi, F., Ghorbandordinejad, F., Rezaee, M., & Jafari, M. (2011). Procedia Computer A Comparison of the Use of Educational Technology in the Developed / Developing Countries. *Procedia Computer Science*, *3*, 374–377. http://doi.org/10.1016/j.procs.2010.12.063

Hashim, J. (2007). Information Communication Technology (ICT) Adoption Among SME Owners in Malaysia. *International Journal of Business and Information*, *2*(2), 221–240.

Hassan, M. a, Hassan, M. S., Shaffril, H. a M., & d'Silva, J. L. (2009). Problems and obstacles in using Information and Communication Technology (ICT) among Malaysian agro-based entrepreneurs. *European Journal of Scientific Research*, *36*(1), 93–101. Retrieved from http://www.scopus.com/inward/record.url?eid=2-s2.0-70349826866&partnerID=40&md5=28f897baa8609ef7bcd577e574dd55ac

Hassan, S., Hassan, M. A., Samah, B. A., Ismail, N., & Shaffril, H. A. M. (2008). Use of Information and Communication Technology (ICT) among Agri – based Entrepreneurs in Malaysia. *World Conference on Agricultural Information and It*, 753–762.

Hayrol Azri. (2011). Ict Use Among Members Of The Village Of The Village Developmetn and Security Committee In Malaysia.

Heber, D. (2004). Vegetables, fruits and phytoestrogens in the prevention of diseases. *Journal of Postgraduate Medicine*, *50*(2), 145–149. http://doi.org/10.1007/s00394-012-0380-y

Hu, Y., & Fu, L. (2012). Targeting cancer stem cells: a new therapy to cure cancer patients. *American Journal of Cancer Research*, *2*(3), 340–56. Retrieved from http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3365812&tool=pmcentrez&rendertype=abstract

Indjikian, R., & Siegel, D. S. (2005). The impact of investment in IT on economic

performance: Implications for developing countries. *World Development*, *33*(5), 681–700. http://doi.org/10.1016/j.worlddev.2005.01.004

Indrati, A., Minaji, E., Binastuti, S., & Roharjo, P. D. (2001). Comparation of Model Unified Theory of Acceptance and Use Technology (UTAUT) And Technology Acceptance Model (TAM) for Internet Adoption of Credit Union Staff. *The First International Credit Union Conference on Social Microfinance and Community Development*, 1–6.

Indrati, A., Minaji, E., Binastuti, S., Roharjo, P. D., Abdekhoda, M., Ahmadi, M., … Ramayah, T. (2012a). Refining the definition of sustainable agriculture: An inclusive perspective from malaysian vegetable sector. *Maejo International Journal of Science and Technology*, *6*(3), 379–396. http://doi.org/10.5897/AJBM10.1398

Indrati, A., Minaji, E., Binastuti, S., Roharjo, P. D., Abdekhoda, M., Ahmadi, M., … Ramayah, T. (2012b). Validity of the technology acceptance model (tam): a sensemaking perspective. *Ijms*, *6*(1), 99–120. http://doi.org/10.5897/AJBM10.1398

Indrati, A., Minaji, E., Binastuti, S., Roharjo, P. D., Abdekhoda, M., Ahmadi, M., … Ramayah, T. (2013). A questionnaire approach based on the technology acceptance model for mobile tracking on patient progress applications. *Journal of Computer Science*, *9*(6), 763–770. http://doi.org/10.3844/jcssp.2013.763.770

Information, U. S. E. O. F., Literacy, I., & Agriculture, I. N. (2015). International Journal of Agricultural Extension USE OF INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) TO ACHIEVE, *03*(02), 111–122.

Issn, P. (2014). Information Communication Technologies in Agricultural Extension Delivery of Agricultural Transformation Agenda, *4*(4), 221–228.

Journal, T. O. (2013). The Official Journal of the Pacific Northwest Library, *77*(2), 1–164.

Kotler, P. (1997). Prinsip-Prinsip Pemasaran. *Edisi Ketiga. Jilid 1, Penerbit Erlangga, Jakarta.*, 1–63.

Kung-Teck, W., Rosma, O., Pauline Swee Choo, G., & Mohd Khairezan, R. (2013). Understanding Student Teachers ' Behavioural Intention to Use Technology : Technology Acceptance Model (TAM) Validation and Testing. *International Journal of Instruction*, *6*(1), 89–104.

Kuriyama, M. (2016). Production and Processing of Palm Oil Self Introduction.

Ladang, D. A. N. T. (2015). Vegetables and Cash Crops Statistic.

León, O. A., Igartua, J. I., & Ganzarain, J. (2016). Relationship between the use of ICT and the degree and type of diversification. *Procedia - Procedia Computer Science*, *100*, 1191–1199. http://doi.org/10.1016/j.procs.2016.09.138

Leser, R., Baca, A., & Uhlig, J. (2011). Effectiveness of multimedia-supported education in practical sports courses. *Journal of Sports Science and Medicine*, *10*(1), 184–192.

Li, Z. (2012). Application of online multimedia courseware in college English teaching based on constructivism theory. *English Language Teaching*, *5*(3), 197–201. http://doi.org/10.5539/elt.v5n3p197

Luhan, J., & Novotná, V. (2015). ICT Use in EU According to National Models of Behaviour. *Procedia - Social and Behavioral Sciences*, *213*, 80–85. http://doi.org/10.1016/j.sbspro.2015.11.407

Madadi, Y., Iravani, H., & Nazari, S. (2011). Factors effective on Familiarity and Usage of Information and Communication Technology (ICT) University College of Agriculture and Natural Resources , University of Tehran , Iran. *Procedia - Social and Behavioral Sciences*, *15*, 3625–3632. http://doi.org/10.1016/j.sbspro.2011.04.346

Mahamod, Z., & Noor, N. A. M. (2011). Persepsi guru tentang penggunaan aplikasi multimedia dalam pengajaran komponen sastera bahasa Melayu. *GEMA Online Journal of Language Studies*, *11*(3), 163–177.

Mahamood, A. F., Nordin, N., Suhairi, H., & Bakar, A. (n.d.). Pertanian Oleh Para Pegawai Pertanian Di Malaysia, 654–666.

Matsubara, T. (2016). Challenges for upgrading productivity and quality of Agriculture in South-East Asia Introduction of Yanmar.

Mikalista, S. M. (2010). Gender-specific constraints affecting technology use and household food security in Western Province of Kenya. *African Journal of Food, Agriculture, Nutrition and Development*, *10*(4), 2324–2343. http://doi.org/10.4314/ajfand.v10i4.55327

Ministry of Agriculture (MOA). (2011). Dasar AgroMakanan Negara (2011-2020), 112. http://doi.org/10.1007/s13398-014-0173-7.2

Mohd Kosnin Azlina And Che Ahmad, M. (2010). Tahap Kesediaan Pengetahuan Dan Kemahiran Amali Guru-Guru PKPG Sekolah Rendah Mengajar Kemahiran Hidup Di Sekolah Menengah. *Tahap Kesediaan Pengetahuan*, (April), 1–6. Retrieved from

http://www.fp.utm.my/ePusatSumber/pdffail/ptkghdfwP/MAZLIFAHBP050234D2008TTP.pdf

Morris, M. G., Hall, M., Davis, G. B., Davis, F. D., & Walton, S. M. (2003). U SER A CCEPTANCE OF I NFORMATION T ECHNOLOGY : T OWARD A U NIFIED V IEW 1, *27*(3), 425–478.

Mtega, W. P., & Msungu, A. C. (2013). Using information and communication technologies for enhancing the accessibility of agricultural information for improved agricultural production in tanzania. *Electronic Journal of Information Systems in Developing Countries*, *56*(1), 1–14.

Mustapha, R., & Abdullah, N. C. (2011). Amalan Pengurusan Perniagaan Usahawan Tani IKS Bumiputera: Satu Kajian Kes Di Negeri Terengganu. *Jurnal Teknologi*, 1–26. http://doi.org/http://dx.doi.org/10.11113/jt.v55.82

Nair, I., & Das, V. M. (2012). Using technology acceptance model to assess teachers' attitude towards use of technology as teaching tool: A SEM Approach. *International Journal of Computer Applications*, *42*(2), 1–6. http://doi.org/10.5120/5661-7691

Nawi, N. M. (2009). AN OVERVIEW OF THE SUPPLY CHAIN MANAGEMENT OF MALAYSIAN, *2*, 1–18.

Neumann, D. L., Neumann, M. M., & Hood, M. (2011). Evaluating computer-based simulations, multimedia and animations that help integrate blended learning with lectures in first year statistics. *Australasian Journal of Educational Technology*, *27*(2), 274–289.

Nmadu, J. N., Aiyelitsoya, F. a., & Sallawu, H. (2013). Use of ICT in Securing Marketing Information among Small Scale Farmers in Niger State, Nigeria. *International Journal of Trade, Economics and Finance*, *4*(2), 66–72. http://doi.org/10.7763/IJTEF.2013.V4.262

Norazah, N., & Ngau, H. (2009). Pembangunan dan Penilaian Bahan Pengajaran dan Pembelajaran Berasaskan Web – Webquest bagi Mata Pelajaran ICT (Development and Evaluation of Webquest for Information and Communication Technology Subject). *Jurnal Pendidikan Malaysia*, *34*(1), 111–129. Retrieved from journalarticle.ukm.my/213/1/1.pdf

Nur, N., Abdul, B., & Gs, R. (1962). Influence of Chitosan on the Production of Secondary Metabolites through Callus Culture of Catharanthus roseus (Arial , Bold , Size 14).

Of, U. S. E., Media, E., & Farm, I. N. (2007). Uporaba Elektronskih Medijev Na

Turističnih.

Okello, J. J., Kirui, O., Njiraini, G. W., & Gitonga, Z. (2012). Drivers of Use of Information and Communication Technologies by Farm Households: The Case of Smallholder Farmers in Kenya. *Journal of Agricultural Science*, *4*(2), 111–124. http://doi.org/10.5539/jas.v4n2p111

Okello, J. J., Narrod, C. a., & Roy, D. (2011). Export Standards, Market Institutions and Smallholder Farmer Exclusion from Fresh Export Vegetable High Value Chains: Experiences from Ethiopia, Kenya and Zambia. *Journal of Agricultural Science*, *3*(4), 188–195. http://doi.org/10.5539/jas.v3n4p188

Oladele, O. I., & Fawole, O. P. (2007). Farmers Perception of the Relevance of Agriculture Technologies in South-Western Nigeria. *Journal of Human Ecology*, *21*(3), 191–194. Retrieved from http://docs.google.com/viewer?a=v&q=cache:HxCS8K4zpXoJ:www.krepublishers.com/02-Journals/JHE/JHE-21-0-000-000-2007-Web/JHE-21-3-000-000-2007-Abstract-PDF/JHE-21-3-191-194-2007-1498-Oladele-O-I/JHE-21-3-191-194-2007-1498-Oladele-O-I-Tt.pdf+farmers+percepti

Omar, B. (2003). Information and Communication Technology (ICT) for Agricultural Development: Factors Associated With Computer Utilization at Area Farmers Organizations in. Retrieved from http://psasir.upm.edu.my/10238/

Park, S. Y. (2009). An Analysis of the Technology Acceptance Model in Understanding University Students' Behavioral Intention to Use e-Learning. *Educational Technology & Society*, *12*(3), 150–162. http://doi.org/10.1007/s00340-009-3513-0

Pendidikan, F., & Malaya, U. (2010). Garispanduan untuk menulis kertas projek, laporan penyelidikan, disertasi, tesis.

Perceived role of information and communications technology in improving agricultural livelihoods of rural farmers In Imo State , Nigeria. (2016), *4*(February), 29–34.

Philosophy, L. (2013). Use of Information and Communication Technologies (ICTs) by Yam Farmers in Boluwaduro Local Government Area of Osun.

PRICING EFFICIENCY OF THE VEGETABLE MARKET IN MALAYSIA SHARIFAH HASHIM. (1994).

Quan, S., Hao, C., & Jianxin, Y. (2010). Factors influencing the adoption of mobile service in China: An integration of TAM. *Journal of Computers*, *5*(5), 799–806. http://doi.org/10.4304/jcp.5.5.799-806

Rezaei-Moghaddam, K., & Salehi, S. (2010). Agricultural specialists' intention toward precision agriculture technologies: Integrating innovation characteristics to technology acceptance model. *African Journal of Agricultural Research*, *5*(11), 1191–1199. http://doi.org/10.5897/AJAR09.506

Rezai, G. (2008). Universiti putra malaysia.

Rosseni, D., Mazalah, A., M.Faisal, K., Norhaslinda Mohamad, S., Aidah Abdul, K., Nur Ayu, J., Siti Rahayah, A. (2009). Kesahan dan kebolehpercayaan soal selidik gaya e-pembelajaran (else) versi 8.1 menggunakan Model Pengukuran Rasch. *Jurnal Pengukuran Kualiti Dan Analisis*, *5*(2), 15–27.

Saleh Alharbi, S. D. (2014). Using the Technology Acceptance Model in Understanding Academics' Behavioural Intention to Use Learning Management Systems. *International Journal of Advanced Computer Science and Applications(IJACSA)*, *5*(1), 143–155. Retrieved from http://ijacsa.thesai.org/

Singh S. (2003) Simple Random Sampling. In: Advanced Sampling Theory with Applications. Springer, Dordrecht

Sharifah Nor, P., & Kamarul Azman, A. S. (2011). Tahap Kesediaan Penggunaan ICT dalam Pengajaran dan Kesannya Terhadap Hasil Kerja dan Tingkah Laku Murid Prasekolah. *Jurnal Pendidikan Malaysia*, *36*(1), 25–34.

Shroff, R. H., Deneen, C. C., & Ng, E. M. W. (2011). Analysis of the technology acceptance model in examining students' behavioural intention to use an e-portfolio system. *Australasian Journal of Educational Technology*, *27*(4), 600–618.

Siraj, M. (n.d.). A model for ICT based services for agriculture extension in Pakistan KNOWLEDGE FOR LIFE.

Siraj, M., Ejiofor, T., Ahmad, A., Nor Azan, M. Z., Noraidah, S., Abu-Dalbouh, H. M., … Wanigasundera, B. A. D. S. and W. A. D. P. (2012). Information Communication Technologies in Agricultural Extension Delivery of Agricultural Transformation Agenda. *Journal of Educational Psychology*, *4*(1), 2012. http://doi.org/10.5897/AJBM10.1398

Statistik, B. M. (2016). Komunikasi Dan Multimedia Buku Maklumat Statistik Pocket Book of Statistics.

Surendran, P. (2012). Technology Acceptance Model : A Survey of Literature. *International Journal of Business and Social Research*, *2*(4), 175–178.

Suvedi, B. M. (2011). E Valuation of a Gricultural E Xtension and a Dvisory S Ervices,

(September), 1–12.

Tangke, N. (2004). Analisa Penerimaan Penerapan Teknik Audit Berbantuan Komputer (TABK) dengan Menggunakan Technology Acceptance Model (TAM) pada Badan Pemeriksa Keuangan (BPK) RI. *Jurnal Akuntansi & Keuangan*, *6*(1), 10–28.

Technology, E. (2015). Utilization of Information and Communication Technologies (ICTs) by Agricultural Extension Workers in Niger State, Nigeria, *5*(1), 1–6.

Tey, Y. S., Mad Nasir, S., Zainalabidin, M., Jinap, S., & Abdul Gariff, R. A. (2009). Demand for quality vegetables in Malaysia. *International Food Research Journal*, *16*(3), 313–327.

Um, E., Plass, J. L., Hayward, E. O., & Homer, B. D. (2012). Emotional Design in Multimedia Learning. *Journal of Educational Psychology*, *104*(2), 485–498. http://doi.org/10.1037/a0026609

Urquieta, N. R. A., Christie, M. E., & Taylor, D. B. (2009). Effects of access to information on farmer ' s market channel choice : The Case of Potato in Tiraque Sub-watershed (Cochabamba - Bolivia).

Usun, S. (2009). Information and communications technologies (ICT) in teacher education (ITE) programs in the world and Turkey, *1*(1), 331–334. http://doi.org/10.1016/j.sbspro.2009.01.062

Vangeyte, J., Van Weyenberg, B., Hijazi, B., Nuyttens, D., Bobrutzki, K. Von, Haselberg, C. Von, … Thysen, I. (2010). the Ict-Agri Meta Knowledge Base : Designing a Web Based Tool for Mapping and Analysing Research and Development on Ict and Robotics in Agriculture and Environmental Related. *AgEng2010*, 1–6.

Wan, M., Chan, F. W., Zhang, Q., Dodsworth, E., Edge, P., & Low, Y. C. (2008). ICT / E-Learning Readiness Analysis for Farmers in China. *World Conference on Agricultural Information and IT*, 1–8.

Wanigasundera, B. A. D. S. and W. A. D. P. (2014). Use of Information and Communication Technology (ICT) by Extension Officers of the Tea Small Holdings Development Authority of Sri Lanka, *25*(4), 1–16.

Watanabe, K., & Limited, F. (2016). Smart Agriculture in Japan Contents of Today ' s Lecture.

Zainudin Bin Hassan, & Muhamad Azam Bin Jaafar. (2010). Penggunaan Komputer Dan Internet Dalam Pengajaran Dan Pembelajaran Di Kalangan Guru Sekolah Menengah Di Daerah Pasir Mas, Kelantan. *Jurnal Pendidikan*, 9.

Zhang, Y., Wang, L., & Duan, Y. (2016). Agricultural information dissemination using ICTs : A review and analysis of information dissemination models in China. *Information Processing in Agriculture*, *3*(1), 17–29. http://doi.org/10.1016/j.inpa.2015.11.002

Ziegler, A. A., Mietchen, D., Faber, C., von Hausen, W., Schöbel, C., Sellerer, M., … Ramayah, T. (2012). Validity of the technology acceptance model (tam): a sensemaking perspective. *Ijms*, *6*(1), 99–120. http://doi.org/10.5897/AJBM10.1398

Ziegler, A., Mietchen, D., Faber, C., von Hausen, W., Schöbel, C., Sellerer, M., & Ziegler, A. (2011). Effectively incorporating selected multimedia content into medical publications. *BMC Medicine*, *9*(1), 17. http://doi.org/10.1186/1741-7015-9-17