



UNIVERSITI PUTRA MALAYSIA

OFF-FARM EMPLOYMENT AND SPATIAL DISTRIBUTION OF PADDY FARMERS IN INTEGRATED AGRICULTURAL DEVELOPMENT AREA IN NORTH-WEST SELANGOR DETERMINED USING GIS

ELEANOR DANIELLA BT LOKMAN

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By

ELEANOR DANIELLA BT LOKMAN

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

June 2015

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Abstract of thesis presented senate of Universiti Putra Malaysia in fulfilment of the requirements for the Degree of Master of Science

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June 2015

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Most of the paddy farmers in Malaysia are earning low income from paddy plantation due to unstable yield, even the government invests heavily in the sector. The objective of this study is to investigate the involvement and location distribution of 250 paddy farmers and farm households in off-farm employment in IADA NWS using Geographic Information Systems (GIS) to capture a farm location effect on mobility with regional condition, such as to work or to the nearest town. The descriptive analysis was used to describe the respondent's socio-economic profile. The relationship between off-farm participation and the independent variables identified were cross-tabulated. Chi-square was used to test the null hypothesis. The GIS was used to determine the spatial characteristics to off-farm participation in distinctive regions. Results shows The middle age group of 41-50 years old, SPM holders, have less than 5ha of paddy field and earn RM3,500 monthly of paddy farmers who are the majority to join off-farm employment. They usually get involved in agriculture activities including oil palm plantation, fisheries, fruits plantation, working with the government and doing own job. Spatially, the results indicated that most of the paddy farmers involved in off-farm job lives near to the town which in Kuala Selangor, as is less than ten (10) kilometres away from their house and paddy lot. The study shows that doing off-farm employment during their free time is an alternative strategy and has a potential to improve the income and well being of the paddy farmers and their family. Sharing farm and off-farm income of farmers could bring a big impact in the family. Furthermore, the diversification of employment in Malaysia however helps to smooth income by spreading risk across several activities.

Keywords: Off-Farm Emploment, Spatial Analysis, GIS

Abstrak tesis ini dikemukakan kepada Senat Universiti Putra Malaysia Sebagai memenuhi keperluan untuk Ijazah Master Sains

**PEKERJAAN LUAR LADANG DAN TABURAN SPATIAL PESAWAH PADI
DI KAWASAN PEMBANGUNAN PERTANIAN BERSEPADU BARAT LAUT
SELANGOR (NWS) DITENTUKAN MENGGUNAKAN GIS**

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Kebanyakan pesawah di Malaysia memperoleh pendapatan rendah dari penanaman padi disebabkan hasil yang tidak stabil, malah kerajaan telah banyak melabur dalam sektor itu. Objektif kajian adalah untuk mengkaji pengagihan penglibatan dan taburan lokasi 250 orang pesawah dan keluarga pesawah di pekerjaan luar ladang di IADA NWS menggunakan Geographic Information System (GIS) untuk mendapat gambaran kesan lokasi sawah padi ke atas mobiliti dengan keadaan persekitaran daerah, seperti jarak untuk bekerja atau jarak dengan bandar terdekat. Analisis deskriptif digunakan untuk menghuraikan profil sosioekonomi responden. Hubungan antara penyertaan ladang dan pemboleh ubah bebas yang dikenal pasti akan diadu dalam statistik jadual silang (*cross-tabulation*). Khi kuasa dua digunakan untuk menguji hipotesis nol. GIS digunakan untuk menentukan ciri-ciri spatial sebagai salah satu penentu penyertaan kerja luar ladang dalam sesuatu kawasan terlibat. Keputusan menunjukkan pesawah peringkat kumpulan umur 41-50 tahun, lepasan SPM, mempunyai kurang daripada 5ha sawah dan berpendapatan RM3,500 setiap bulan yang merupakan majoriti menyertai pekerjaan luar ladang. Mereka biasanya terlibat dalam aktiviti pertanian termasuk kelapa sawit, perikanan, perladangan buah, penjawat awam dan bekerja sendiri. Keputusan spatial menunjukkan kebanyakan pesawah terlibat dalam kerja luar ladang tinggal berhampiran bandar Kuala Selangor, kurang daripada sepuluh (10) kilometer jauh dari rumah dan lot padi. Kajian mendapati pekerjaan luar ladang semasa waktu lapang merupakan satu strategi alternatif dan mempunyai potensi meningkatkan pendapatan dan kesejahteraan pesawah dan keluarga. Perkongsian pendapatan sawah dan luar ladang boleh membawa satu impak besar kepada keluarga pesawah.

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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

DOA	Department of Agriculture
DID	Department of Irrigation and Drainage
DPN	Dasar Pertanian Negara
GDP	Gross Domestic Product
GIS	Geographic Information System
IADA	Integrated Agricultural Development Area
IADP	Agricultural Development Project
JUPEM	Jabatan Ukur dan Pemetaan Malaysia
KADA	Kemubu Agricultural Development Area
KETARA	Kawasan Pembangunan Pertanian Bersepadu Terengganu Utara
LPP	Lembaga Pertubuhan Peladang
MADA	Muda Agricultural Development Area
NAP	National Agricultural Policy
PPK	Pertubuhan Peladang Kawasan
RMK	Rancangan Malaysia Ke
SPSS	Statistical Package for the Social Sciences
TKIS	Tanjung Karang Irrigation Scheme
UPM	Universiti Putra Malaysia

CHAPTER 1

INTRODUCTION

1.0 Introduction

Agriculture is the science and activities of a farmer in cultivating the farm soil, producing food from plants, doing aquaculture activities and livestock farming. It is an important economic activity, by providing employment for more people across the global than any other activity especially to the rural poor. Agriculture sector took control of more than one-third of the Earth's land surface activities. People do rely directly upon the food from plant, fish and livestock to grow and stay alive.

Geographically, the country Malaysia (Figure 1.1) can be described located in the South-East Asia continent, which is partly on a peninsular of the Asian mainland, known as peninsular Malaysia and the other part is on the northern third of the Borneo island, known as Sabah and Sarawak. Malaysia is also bordered with other countries such as the Indonesia, Singapore, Brunei and Thailand. Malaysia which also sits on the South China Sea in the center of Southeast Asia, is one of the well developing country in the world and compensate a great attention on agricultural activities. In the year 2011, total percentage of arable land is about 5.44%, followed by the total percentage of permanent crops with 17.49% and almost 77.07% are for the other land usage(The World Factbook 2013-14. Washington, DC: Central Intelligence Agency, 2013).

On the contrary, agricultural sector in Malaysia could be simply divided into two main important sectors including the estate sub-sector and the other one is smallholders' sub-sector. The estate sub-sector's holdings are more than 100 acres (40.5 ha) of planting area, consist of highly commercialized, using the latest technologies such as machineries and efficiently managed by the authorities. Usually, the estate sub-sector owned by the private companies, public-listed corporate entities or public land development agencies and they are totally involved in the mass production of industrial crops such as rubber and oil palm plantation.



Figure 1.1: Malaysia Map (The World Factbook 2013-14. Washington, DC: Central Intelligence Agency, 2013).

Otherwise, the smallholders' sub-sector usually managing and operating the average farm size of about 1.45ha. The collective acreage of land is operated by total of 1,033,065 farmers. The people involved in this sector are usually individual farmers with either highly commercialized or not, where almost 75% of the total area under agriculture less commercialized and less efficiently managed. However, the smallholders sub-sector is the main contributors to food crop production and the industrial crop production in Malaysia and farmers gain high income from it.

Thus, Malaysian economy has experienced a very compelling anatomical changes over the last few decades since the independence, where the agricultural sector has plays major but declining role and contributed well to the growth of the national economy. Yet, it is reported that the contribution of agricultural sector to the Malaysian gross domestic product (GDP) has shown reduction pattern and later has decreased during the year 1980's. However, with the recent technology and research development in the agriculture industry, this sector has showed the maturely and one of the contribution in the Malaysia economic. Moreover since the independence, the national economy were contributed majorly by the agriculture activities. The sector however has established the foundation steadily and has been the strength behind the economic growth of the country. Agriculture's income was used to finance the national development, which deliberately led to metamorphosis of the Malaysian economy towards the national industrialization.

Thus, the rapid industrialization during the last decade has forced to a decline curve in the sector's relative contribution to national income, export earnings, employment diversification and total investments. Study done by Siamwalla (1996) and Harron *et al.*, (2001) found that since then, and even though this widely acknowledged role of agriculture in economic development, many academicians, policy makers and policy analysts in the developing countries, international agencies and donor communities turn out to have lost passion in the agricultural sector, often relegating its role 'from engine of growth to sunset status' or arguing for its continuing relevance and importance because of its 'multifunctionality role' (Abd Rahman, 1992).

In the year 2007, Malaysia was the 29th largest economy in the world by purchasing power parity with gross domestic product for 2007 was estimated to be \$357.9 billion with a growth rate of 5% to 7%. Research done by Paweł Bożyk (2006) and N. Gregory Mankiw (2007) claimed that the Southeast Asian nation experienced an economic boom and underwent expeditious development during the late 20th century and has a GDP per capita of \$14,400, being considered a newly industrialized country. Moreover, as indicated in the Ninth Malaysia Plan (2006-2010) document by the Malaysian Government, the rural development continues to be one of the important focus by the government and related agencies in national development plan. Malaysia has achieved substantial success in its rural development, especially in reducing the incidence of poverty in both rural and urban area. Moreover in the process, the rural areas have been developed and equipped with infrastructures, utilities, social amenities, health and school and facilities in order to support the economic development of the country as well as increasing the life quality and standards of the populace. In such a way, the agricultural sectors' productivity and income level of the rural people, the mainstay of the rural economy have steadily showed an improvement and has been increased.

Also, infrastructure and rural development in Malaysia is part and parcel of a well planned and executed process. Growth has always been accompanied by equitable

distribution in all segments of society. Malaysia has thus undertaken to achieve rapid and sustainable economic development because this will provide a larger volume of resources for social development. Study done by Jayawardane (1996), has shown the share of the labour component alone is about 45 per cent.

Perhaps, the agriculture sector creates job offer for the local people if adequate policy changes are introduced, with sufficient funds are pumped into this resource-starved sector. From year 2004 until year 2008, there are increasing amount of the agriculture labour in Malaysia. In line with the strong economic activities in the first half of 2008, labour market conditions strengthened during the period of time. Yet, the condition of national labour market began to dwindle in the second half of the year 2008 as the business in manufacturing sector, turned cautious among the deterioration in external demand showed on the curve pattern (Economic Developments, 2008). For the last 14 years, Malaysia has been the biggest exporter of palm oil and a few other agricultural products including rubber. Besides, Malaysian farmers produce a number of fruits and vegetables for the domestic and international market (Encyclopedia of the Nations, 2010). Nevertheless, the combination of agricultural, livestock and forestry sectors have been showing some pessimistic trend. Considering the country is rich with its agriculture and forestry resources, this is not a good wave.

On the other hand, referring to the Third National Agricultural Policy (NAP3) plan document, the Malaysian government sets and created the strategic directions concerning to advance the national economy for agricultural and forestry development from the year 1998 to the year 2010. The objective of the NAP3 policy is to ensure that the capability of the agricultural sector's strategic role in national development is maintained and boost in light of new and emerging challenges facing agricultural development.

Thus, towards this end, the policy is focusing on new approaches to increase productivity and competitiveness, deepen linkages with related sectors, venture into new frontier areas likewise maintain and utilize natural resources on a sustainable basis. Furthermore, the NAP3 intention is to set in place the enabling and supportive measures as well as creating a useful and helpful environment to promote growth in the agricultural sector. The NAP3 formulated policies by the Malaysian government were designed to continue giving priority on the market driven growth and doing expansion of productivity.

1.1 Paddy Planting In Malaysia

On the other hand, there has been a great history of planting rice under rain fed conditions in pocket areas located along the flood plains of rivers in Malaysia. Two large scale irrigation systems were first introduced, notably in the Kerian Irrigation Scheme and the Wan Mat Saman Scheme, in the early 1900s. Likewise, in year 1932 the Department of Irrigation and Drainage (DID) was established and together with the Department of Agriculture (DOA), they were able to manage and organize systematic irrigation systems for the paddy planting in the involved granary areas. (Raja, 2009). This unit characterizes the main appearance of traditional rice farming in Malaysia, where the rice crop is grown in paddy fields at the granary areas.

The traditional growing of rice is one form of labour-intensive agriculture. This means that much of the work required to cultivate the crop is done by hand. Thus, later the Malaysian paddy farming is mechanized with high level of mechanization in paddy production, where almost fully mechanized in lad preparation and harvesting. The technology adopted into Malaysian rice cultivation coincided during the green revolution. The early seventies witnessed beginning of double cropping in Malaysia and the paddy is produced in two seasons per year. Jegatheesan (1977) and Kalshoven *et al.*, (1984) found that in that duration, efforts were made to increase rice production and a variety of developmental policies were promoted for rice agriculture.

Likewise, rice is an important staple food in the Malaysian diet. In the interest of the country to maintain at least a 65 per cent level of self-sufficiency in rice, the Malaysian government has always taken measures on economic policies to ensure the goal is reached all the time. The Malaysian government invests heavily in the rice sector for economic reasons by supporting the paddy farmers with free services for the farmers, input subsidies and output incentives; however; the profit margins shows declined, sharply. Concerning the labour, farm power, fertilizer and agro-chemicals demand covers almost 90 per cent of the total yield cost production. Therefore, the participation in off-farm job is essential conducive to boost the economy of the paddy farmers. Income and earnings from off-farm employment is very important to the farmers and rural poor to support their daily expenses. Thus, a research done by Shand (1983) claimed that off-farm employment refers to any non-farm activities or occupations that are undertaken by every working member of the rural household. Yet, paddy farmers are continually faced with employment decisions off the farm. On the other hand, there are many significant opportunities for effective participatory planning and implementation of agricultural and rural development activities in an area involved, which combine resources, related technologies and local knowledge of government and private institution.

Occasionally, off-farm earnings tended to be under the control of the income earner, such as a paddy farmer and used to support households' expenditure rather than directly support the farm business (Radam *et al.*, 1995). In such a way, there is a need for generation of sustainable labour intensive in agricultural production plan and large-scale off-farm employment opportunities for low income farmers, a large number of landless and other rural people. Furthermore, the rural poor, which depends upon off-farm employment for extra income, the community in general through lower food prices will benefit from increased income opportunities from growing demand for non-farm products, tools and consumer goods in the rural areas.

1.2 IADA North West Selangor (IADA NWS)

Moreover, the Seventh Malaysia plans' (1996- 2000) goal was set by the government to optimise the usage of limited resources; the eight Integrated Agricultural Development Area (IADA) implementation scope has been focused on regional development area. The integrated approach between the Ministry of Malaysian Agriculture and agricultural based with other related government or private agencies is required to facilitate the preparation of agriculture infrastructure, related technologies and support services which related to the paddy farmers.

Each Integrated Agricultural Development Area (IADA) objective is to enhance and advance maximize target group's income so that the income disparity with other sectors could be reduced, including increasing the system efficiency by modernising the agricultural sector produce the manpower that can compete with the local and foreign market, develop target group to become a progressively an independent disciplined society, an enthusiastic entrepreneurship and to increase rice crop average production to the level of 6.5 metric tonnes each hectare a season from year 2010.

Thusly, the concept of Integrated Agricultural Development Area (IADA) in an integrated concept based on development was inaugurated in year 1965 with Muda Agricultural Development Authority (MADA) followed by the formation of Kemubu Agricultural Development Authority (KADA) in year 1967. Since then, such development concept has been implemented and developed with the establishment of another eight Integrated Agricultural Development Area (IADA) in the country, including IADA in North West Selangor, IADA Seberang Perak, IADA Kerian Sg. Manik, IADA Kemasin Semerak, IADA Penang, Kawasan Pembangunan Pertanian Bersepadu Terengganu Utara (KETARA), IADA Samarahan and IADA Kalaka Saribas in Sarawak in order to organize the paddy farming in Malaysia. The total of physical area in eight IADA paddy area gazetted was 923,565 ha, project area with 482,580 ha and agriculture area with 204,374 ha(Raja, 2009).

Likewise, in 1932, the rice bowl area in Selangor had being delve into an area of 50,000 acres and in year 1936, the granary area were established and recognized as Tanjung Karang Irrigation Scheme (TKIS). It comprises the area of Kuala Selangor and Sabak Bernam district. The paddy planting area covered were about 60 per cent (20,000 ha). The development works had been carried then until 1941, by the British government in the Malaya. Infrastructure development works were put to halt due to war and reassumed in the year of 1948. Beginning the year 1962, when double cropping was successfully introduced to an area of 2,000 acres and the paddy yield were around 2.5 mt/ha. Paddy holdings in these granary areas tend to be standardized and sub divided with 1.2 ha as an average (Taylor, 1981). By the year 1978, Integrated. Agricultural Development Project (IADP) North West Selangor was launched and had major infrastructure improved. More area with double cropping intensity achieved due to an intensified infrastructures and efficiency. IADP were later known as Integrated Agricultural Development Area (IADA) (Map 1.2), monitored by the Department of Agriculture to assist the government and the farmers to improve their paddy farming IADA NWS is one of the agency successfully developed with the best infrastructure among the main granary areas in Malaysia and the highest producer of rice in the country (Raja, 2009).

object for an example the household home address or small unit of survey data. It is different compared to physical object such as road or hill, as its difficult to predict the real location of an individual people.

The database is the most important component in GIS where GIS covers data model attribute and spatial data. claimed that GIS could integrate the attribute data model and spatial data model which later on can be integrate with sharing ID. Without a database, GIS is useless (Clarke, 1997). Thus, well-trained people with knowledge in spatial analysis and skills in using GIS software are crucial to the GIS process. There are three important factors to the people as component of GIS including education, career path, and networking. Balancing the inputs and outputs on a farm is a fundamental in order to analyse farm's success and profitability. The ability of analysing and visualizing the agriculture environment and workflows in the GIS has proven to be very beneficial to the farming industry. Both the GIS and GIS system are playing important and increasing role in the agricultural sector throughout the world by helping farmers increase their farm production, reduces farm costs and furthermore, farmers will have the ability to manage their time and land more efficiently.

1.5 Problem Statement

Other than the paddy farmers' contribution to the Malaysian economy, they also play an important role in shaping and maintaining the landscape of environment. The Malaysian paddy farmers gets all the supports from the government including input subsidies and output incentives, where the government invests heavily in the rice sector for economic reasons. However, with the farmers still earn low profit which income from paddy alone is not enough to cover up living cost especially the price of paddy inputs keep on increasing. For that reason, it will be useful when farmers could get benefit from the subsidies given.

The important link between farm households and the rural economy is through income earned from off-farm employment. There are about 1,234 farm families in Malaysia that lives under the poverty line (Mohd Ayop, 2013). 30% from Selangor's population are living under the poverty line in year 2014, with total income of less than RM1,500.00 monthly (Ganabatirau , 2014). IADAS' farmers average income had improved from RM238 per month in 1977 to RM1,326 per month in year 2006. With this earnings improvement also succeeded reduce poverty rate in Northwest Selangor area from 67 percent before IADA (before 1977) to only 0.26 percent in year 2003 (Abdul Hamed , 2008). A study done by Rabu and Shah (2013) at IADA NWS, Kemubu Agricultural Development Authority (KADA) and Muda Agricultural Development Authority (MADA) shows that paddy cultivation activities in IADA NWS and MADA were not able to generate sufficient income for farmers, thus, they have to find other sources of income to sustain their livelihood.

The way to diversify the income is through off-farm employment. The off-farm employment joining decision was influenced by non spatial and spatial characteristics. The non spatial characteristics (preferences in agricultural activities, paddy farming, on and off-farm employment) and spatial characteristics (distribution, distance and demography) were the important factors influences IADA NWS paddy farmers and farm households' joining decision in off-farm employment. Therefore, the aim of this research is to get an overview on how household, farm and spatial characteristics

determine the share income from off-farm employment and how they affect the spatial patterns of farmers that can benefit from it.

The level of rurality of a place also seems to play an important factor that lead to join off farm employment. The more rural a location is, the less likely a farmer will engage in off-farm activities, mainly due to no effective networks and high travel costs. Distance to the nearest concentration of jobs and distance to the nearest city as related variables that probably have an impact on the share and involvement of off-farm activity among the farmers. Locations, geographically however does affect a farmers or households decision to join off farm activities distribution. Leeuwen et al. (2008) found that the location of farm households along the spatial gradient does affects resource availability and farmers' livelihoods in the studied area.

Therefore, study done by Radam *et al.*, (1995) shows that the participation in off-farm employment is an important strategy in order to improve the economy of paddy farmers besides getting themselves relieve from poverty. Thus, off-farm employment promises a better income compared to the on farm employment. Another research found that farm income is much more variable than off-farm income because of the big risk of the farming business. Furthermore, the rural poor, which depend upon off-farm employment, will get benefit from increased income opportunities from growing demand for non-farm products, tools and consumer goods they produce in the rural areas in general over lower food prices (Mishra and Goodwin, 1997).

1.6 Research Questions

The research questions for the study are:

- 1) What are the type of off-farm works available in the study area and income level of the farm households from the farming activities and off-farm job activities?
- 2) What is the relationship between respondents' personal characteristics like as age, education, gender, dependents, farming experience, total income, farm size and participation in off-farm employment at IADA NWS?
- 3) What are the spatial characteristic variables in terms of on and off-farm employment distribution using the GIS spatial analysis?

1.7 Objectives of The Study

1.7.1 Objectives

The objective of this study is to investigate the involvement and location distribution of paddy farmers and farm households in off-farm employment in IADA NWS using GIS to capture a farm location effect on mobility with regional condition, such as to work or to the nearest town.

1.7.2 Specific Objectives

Specifically, the objectives of this study are:

- 1) To determine the personal demographic background of IADA NWS paddy farmers.
- 2) To identify type of off farm works available in the study area and to examine the income level of the farm households from the farming activities and off-farm job activities at IADA NWS.
- 3) To investigate the relationship between respondents' personal characteristics like as age, education, gender, dependents, farming experience, total income, farm size and participation in off-farm employment at IADA NWS.
- 4) To examine the spatial characteristics variable in terms of on and off-farm employment distribution using the GIS spatial analysis.

1.8 Scope and Limitation of Study

There are few scopes and limitations which should be taken into account and it should be seen as important opportunities for research under the same theme. Focus of the study is to investigate the involvement of paddy farmers and farm households in off-farm job employment at IADA NWS and the spatial distribution using GIS.

The scope of this study are the limitation in the socio-economic aspect and the spatial distribution of the off-farm employment activities using GIS. The socio-economic status of the IADA NWS paddy farmers is addressed here with respect to age, education, dependents, other income, farm size, farm type and much more. The impacts of the study are in term of change in skills relate to off-farm employment, aspects of life style, properties holding, assets, income and economic. The spatial distribution of off-farm employment is presented here on the map based including the location of paddy location, off-farm employment location, paddy farmers' house location and the nearest town location using GIS. Such information serves as a benchmark to gauge the progress of development on the livelihood and living conditions of the IADA NWS paddy farmers.

Another limitation is the limitation of respondents where it is only limited to IADA paddy farmers and heir household who involves in off-farm employment. The researcher decided to focus only on type of off-farm employment and their spatial distribution. The on farm terms are referring to paddy farming activities while, the off-farm employment is referring to other than paddy farming activities. 250 sample of respondents is statistically acceptable for the study. Other than that, the weaknesses of the data collection were: different interpretations among respondents and communication barrier because the age and education level of respondents.

1.9 Significance of the Study

While Malaysia is moving rapidly towards industrialization, food production, particularly in the case of its rice will continue to receive the attention of the economic planners and policy makers. The findings of the study are beneficial not only to the IADA farmers in the study area, but also the policy makers in formulating rural development policies that will meet the needs of farmers thereby increase the job opportunities in the rural areas and consequently improving the farm family income and the viability of farms.

It will help the farmers in making the necessary adjustments required to increase living standard of their household members by engaging in off-farm employment and it will also help other researchers who will conduct research on the same area. In addition, it will also serve as a future reference for researchers who are interested in studying agriculture programme, rural development programme and related field. Finally, the finding of this study would provide valuable input to government policy makers.

1.10 Thesis Organization

In this thesis, there are 5 chapters which are the content of this study starting with introduction, literature review, methodology, results and discussions, and lastly are conclusion and recommendation. Yet earlier, before the chapter of Introduction were presented, the indexes of Acknowledgement, followed by the Declaration and Abstract, later, the Table of Contents, List of Tables and List of Figures and Abbreviations were listed accordingly to guide and facilitate the readers.

In Chapter One, it is about the Introduction of the study. This chapter covers about the agriculture sector in Malaysia, Paddy planting in Malaysia, Integrated Agricultural Development Area Northwest (IADA NWS), off farm employment, Geographic Information System (GIS), problem statement, objective of study, significant of study and finally, the thesis organization.

In Chapter Two, previous research on related topic was used as references to get the view of this study. The chapter started with the introduction, the definitions, the importance and decision to get engage with off farm employment of paddy farmers. The topic then has been summarized after the previous research on GIS, spatial distribution of off farm employment were later being identified.

Chapter Three is Methodology of the Study. Started with the introduction, this chapter answers the entire question about how this studies done, with the conceptual framework, where is the location of study, the respondents' selection and sampling techniques, justifications of the chosen study area, the data sources of this study, questionnaire design, the hypothesis and explains how the data collected being analyzed.

Chapter Four represent the Results and Discussion of the study. The results and discussions obtained from the data collected and analyzed. In it included respondents' demographic profile, off farm participation and employment, relationship between dependents and independents variables, chi-square results and spatial analysis result.

The last but not least, was Chapter Five which stated with the introduction of the study, followed by the Summary and the Conclusion and continued with the Recommendation of the study. Yet, the limitations of the study and recommendation for future research all has been discussed in the final chapter. Finally, all the references were included after this last chapter.

REFERENCES

- Abd Rahman, A. (1992). Agricultural Development in Malaysia: Retrospect and Prospects. *Journal of Economic Cooperation Among Islamic Countries*, 13:3-4:51-86.
- Asmak, A. R. & Othman, P. (2005). Kaedah taksiran zakat padi dan kesannya terhadap petani: Kajian di Selangor. *Jurnal Syariah*, 13(1), 37-63.
- Abdul Hamed, B. (2008). *IADA majukan pertanian barat laut Selangor*.media. 14 February, Utusan Online, IADA Barat Laut Selangor, viewed 13 August 2014.
- Agriculture Statistical Handbook. (2008). "Paddy". Ministry of Agriculture. Malaysia.
- Alam, M. M., Siwar, C., Murad M.W., & Toriman M. E. (2011). Impacts of Climate Change on Agriculture and Food Security Issues in Malaysia: An Empirical Study on Farm Level Assessment. *World Applied Sciences Journal*, 14(3): pp. 431-442.
- Alam, M. M., Siwar, C., Murad, M. W., Molla, R. I., & Toriman, M. E. B. (2010). Socioeconomic profile of farmer in Malaysia: study on integrated Agricultural development area in North-West Selangor. *Agricultural Economics and Rural Development*, 7(2), 249-26. Mankiw, N. G. (4th Edition 2007). *Principles of Economics*. ISBN 0-32- 422472-9.
- Alasia, A., Weersink, A., Bollman, R. D., & Cranfield, J. (2009). Off-farm labour decision of Canadian farm operators: Urbanization effects and rural labour market linkages. *Journal of rural studies*, 25(1), 12-24.
- Allen, J., Browne, M., & Cherrett, T. (2012). Investigating relationships between road freight transport, facility location, logistics management and urban form. *Journal of Transport Geography*, 24, 45-57.
- Araujo, C., de Janvry, A., & Sadoulet, E. (2003). Measuring the role of social networks on behavior with an application to rural off-farm employment. *Department of Agricultural and Resource Economics University of California Berkeley. Mimeo.*
- Ayop, M.A.R. (2013). *Kejayaan Malaysia Dalam Program Basmi Kemiskinan*. Kategori Sosial/Ekonomi. Bahagian Penerbitan Dasar Negara, Jabatan Penerangan Malaysia, Kementerian Penerangan, Komunikasi dan Kebudayaan, Malaysia.
- Bartlett, C.A & Goshal S. (1991). Global Strategic Management: Impact On The New Frontiers of Strategy Research. *Strategic Management Journal*, Vol. 12, 5-16 (1991).
- Baumgartner, H.W. (1965). Potential Mobility in Agriculture: Some Reasons for the Existence of A Labor-Transfer Problem. *Journal of Farm Economics*, 47(1): 74-82.

- Benjamin, D., & Brandt, L. (2002). Property rights, labour markets, and efficiency in a transition economy: the case of rural China. *Canadian Journal of Economics*, 689-716.
- Benjamin, C., & Guyomard, H. (1994). Off-farm work decisions of French agricultural households. *Agricultural household modelling and family economics*, 65-86.
- Benjamin, D. (1992). Household composition, labor markets, and labor demand: testing for separation in agricultural household models. *Econometrica: Journal of the Econometric Society*, 287-322.
- Bhatta, G. D., & Doppler, W. (2010). Farming differentiation in the rural-urban interface of the middle mountains, Nepal: Application of analytic hierarchy process (AHP) modeling. *Journal of Agricultural Science*, 2(4), p37.
- Bhatta, G.D., & Doppler, W. (2011). Smallholder Peri-urban Organic Farming in Nepal: A Comparative Analysis of Farming Systems. *Journal of Agriculture, Systems and Community Development 1 (3): 163-180*.
- Bhatta, G.D. (2010). Socio-economic and Spatial Assessment of Smallholder Peri-urban Farming in Middle Mountains of Nepal. Weikersheim, Germany: Margraf Verlag.
- Bhatta, G. D., Doppler, W., & KC, B. (2009). Spatial differentiation in farming practices and their impact on rural livelihood: A case from hills of Nepal. In *Conference on International Research on Food Security, Natural Resource Management and Rural Development, Hamburg, Germany, October* (pp. 6-8).
- Bowler, I. (1992). 'Sustainable Agriculture' as an Alternative Path of Farm Business Development. In: Bowler, I.R., Bryant, C.R. and Nellis, M.D. (Eds.). *Contemporary Rural Systems in Transition, Vol. 1: Agriculture and Environment*. CAB International, Wallingford, pp. 237-253.
- Bahadur, K.C., (2005). Combining Socio-economic and Spatial Methodologies in Rural Resources and Livelihood Development: A Case from Mountains of Nepal. Weikersheim, Germany: Universität Hohenheim, Margraf Verlag.
- Brown, S. (2003). Spatial analysis of socioeconomic issues: Gender and GIS in Nepal. *Mountain Research and Development*, 23(4), 338-344.
- Buckley, D. J. (1997). *The GIS Primer: An Introduction to Geographic Information Systems*. USA: Pacific Meridian Resources, Inc.
- Burrough, P.A. (1986) *Principles of Geographic Information Systems for Land Resource Assessment*. Monographs on Soil and Resources Survey No. 12, Oxford Science Publications, New York. Oxford University Press.
- Carlin, T. A. & Green, B. L. (1988). Local Farm Structure and Community Ties. Agriculture and Rural Economy Division, Economic Research Service, United States Department of Agriculture. Research report No. 68.

- Chaplin, H., Davidova, S., & Gorton, M. (2004). Agricultural adjustment and the Diversification of farm households and corporate farms in Central Europe. *Journal of rural studies*, 20(1), 61-77.
- Chayanov, A.V. (1986). *The Theory of Peasant Economy*. Wisconsin University Press.
- Che-Mat, S. H., Nor'Aznin, A. B., & Zafarullah, A. A. J. (2012). Pendapatan Bukan Pertanian Dan Sumbangannya Dalam Memendekkan Tempoh Masa Keluar Daripada Kepompong Kemiskinan. *Kajian Malaysia: Journal of Malaysian Studies*; 30 (2), pp. 95-121.
- Clarke, Keith C. (1995). *Analytical and Computer Cartography*. Edited by K. C. Clarke. 2nd ed. Prentice Hall Series in Geographic Information Science. Upper Saddle River, NJ: Prentice Hall.
- Clarke, K. C. (1997). *Getting started with geographic information systems* (Vol. 3). Upper Saddle River, NJ: Prentice Hall.
- Clifford, J. M. (2009). *Grids and Datum Malaysia*. *Photogrammetric Engineering & Remote Sensing*; 75(4), 345-347.
- Cook, S. (1999). Surplus Labor and Productivity in Chinese Agriculture: Evidence from Household Survey Data. *Journal of Development Studies* 35(3): 16-44.
- Corner, L. (1981). *The Impact of Rural Outmigration: Labour Supply and Cultivation Techniques in a Double-cropped Padi Area-West Malaysia* (Doctoral dissertation, Macquarie University).
- Corsi, A., & Findeis, J. L. (2000). True state dependence and heterogeneity in off-farm labour participation. *European Review of Agricultural Economics*, 27(2), 127-151.
- Corsi, A. (1993). Pluriactivity: The determinants of agricultural households' choices. *Cahiers d'Economie et Sociologie Rurales* 26.
- De Brauw, A. (2003). Are women taking over the farm in China. *Paper provided by Department of Economics, Williams College in its series Department of Economics Working Papers* with, (199).
- De Brauw, A., Huang, J., Rozelle, S., Zhang, L., & Zhang, Y. (2002). The evolution of China's rural labor markets during the reforms. *Journal of Comparative Economics*, 30(2), 329-353.
- De Janvry, A., & Sadoulet, E. (2001). Income strategies among rural households in Mexico: The role of off-farm activities. *World development*, 29(3), 467-480.
- Deichmann, U. (1996). *Biologists under Hitler*: translated by Thomas Dunlap. Pp 335. Harvard University Press, 1996. Development analysis network, Phnom Penh (2003). *Agricultural Development and Climate Change*. CDRI- Cambodia's Leading Independent Development Policy Research Institute. ROS Bansok,

NANG Phirun and Chhim Chhun, Working Paper Series No. 65, December 2011, CDRI Publication.

- Ellis, F. (1993). *Peasant economics: Farm households in agrarian development* (Vol. 23). Cambridge University Press.
- Ellis, F. (2000). Rural livelihoods and diversity in developing countries. Oxford: Oxford Development Press. Encyclopedia of the Nations. (2010). "Malaysia Agriculture, Information about Agriculture in Malaysia". Retrieved from [://www.nationsencyclopedia.com/economies/Asia-and-the-Pacific/Malaysia/AGRICULTURE.html](http://www.nationsencyclopedia.com/economies/Asia-and-the-Pacific/Malaysia/AGRICULTURE.html) (Accessed 12th May 2014)
- Fahmi, Z., Samah, B. A., & Abdullah, H. (2013). Paddy Industry and Paddy Farmers Well-being: A Success Recipe for Agriculture Industry in Malaysia. *Asian Social Science*, 9(3), p177.
- Ferreira, F. H., & Lanjouw, P. (2001). Rural nonfarm activities and poverty in the Brazilian Northeast. *World Development*, 29(3), 509-528.
- Fuguitt, G. V. (1959) Part-time Farming and the Push-Pull Hypothesis. *American Journal of Sociology*. 64(3): 75-79.
- Fujimoto, A. (1995). Structure and changing patterns of rural employment in Malaysia: a study of rice growing village. In Mizuno, K. *Rural employment in Southeast Asia* (pp.211-243). Institute of Developing Economies, Japan.
- Ganabatirau, V. (2014). Mesyuarat Ketiga, Penggal Kedua, Dewan Negeri Selangor Yang Ketiga Belas, Page 107, 2 Disember, Dewan Negeri Selangor, Shah Alam.
- Gardner, B. L. (2001). How U.S. Agriculture Learned to Grow: Causes and Consequences. Alan Lloyd Address, Adelaide, Canada.
- Ghafari, A., Cook, H. F., & Lee, H. C. (2000, September). Integrating climate, soil and crop information: a land suitability study using GIS. In *Proceedings of the 4th International Conference on Integrating GIS and Environmental Modeling (GIS/EM4): Problems, Prospects and Research Needs, Banff, Alberta, Canada, September* (pp. 2-8).
- Goodchild, M. F. (1992). Geographical information science. *International Journal of Geographical Information Systems* 6 (1, Jan.-Feb.).
- Goodwin, K. B., & Matthew, H. T. (2002). Parametric and Semiparametric Modeling of The Off-Farm Labor Supply of Agrarian Households in Transition Bulgaria. *American Journal of Agricultural Economics*. 84(1): 184-209.
- Greene, W. H. (2000). *Econometric Analysis*. New Jersey: Prentice-Hall International, Inc.

- Gunter, L. & McNamara, K. T. (1990). 'The impact of local market conditions on the off-farm earnings of farm operators', *Southern Journal of Agricultural Economics*, vol. 22, pp. 155±65.
- Gujarati, D. N. (2003). *Basic Econometrics*. New York: McGraw-Hill/Irwin.
- Haining, R. (1990). *Spatial Data Analysis in the Social and Environmental Sciences*, Cambridge University Press, Cambridge
- Hambleton, R. (2001). FBMM News Column. Kevin Brooks Project Coordinator Extension Educator, Farm Business Management and Marketing, Effingham Center.
- Harron, M. H., Shamsudin, M. N., & Latif, I. A. (2001). Challenges for Agribusiness: A case for Malaysia. In *International Symposium Agribusiness Management towards Strengthening Agricultural Development and Trade, Chiang Mai University: Thailand*.
- Howard, W., & Swidinsky, M. (2000). Estimating the Off-farm Labor Supply in Canada. *Canadian Journal of Agricultural Economics/Revue canadienne d'agroeconomie*, 48(1), 1-14.
- Huffman, W. E. (1976). The Value of the Productive Time of Farm Wives. *American Journal of Agricultural Economics*, 58, 836-841.
- Huffman, W. E. (1980). Farm and off-farm work decisions: The role of human capital. *The Review of Economics and Statistics*, 14-23.
- Huffman, W. E., & Lange, M. D. (1989). Off-farm work decisions of husbands and wives: joint decision making. *The Review of Economics and Statistics*, 471-480.
- Jayawardane, S. N. (1996). Socio-economic constraints and future prospects for crop diversification in minor irrigation schemes. In *workshop on crop diversification, Colombo*.
- Jegatheesan, S. (1977). The green revolution and the Muda irrigation scheme; an analysis of its impact on the size structure and distribution of rice farmers' incomes [in Malaysia]. *MADA Monograph (Malaysia)*. no. 30.
- Fairweather, J. R. (1999). Understanding how farmers choose between organic and conventional production: Results from New Zealand and policy implications. *Agriculture and human values*, 16(1), 51-63.
- Kalshoven, G., Daane, J. R. V., Fredericks, L. J., Steen van Ommeren, F., & Tilburg, A. V. (1984). *Paddy farmers, irrigation and agricultural services in Malaysia: a case study in the Kemubu Scheme*.
- Keating, N. C., & Munro, B. (1989). Transferring the family farm: Process and implications. *Family Relations*, 215-219.

- Kementerian Kemajuan Luar Bandar dan Wilayah. 2010. Statistik luar bandar – kemiskinan. Retrived from: <http://www.rurallink.gov.my/464> (accessed 20 March 2010).
- Kimhi Ayal and Lee Myoung-jae. (1996). Off-Farm Work Decisions of Farm Couples: Estimating Structural Simultaneous Equations with Ordered Categorical Dependent Variables. *American Journal of Agricultural Economics*.78: 687-698.
- Lass, D. A., Findeis, J. L., & Hallberg, M. C. (1991). Factors affecting the supply of off- farm labor: a review of empirical evidence. *Multiple Job-holding among Farm Families*, Iowa State University Press, Ames, 239-262.
- Laurie, A.C. (1992). Farm Family Transition to Off-Farm Employment: A Comparison of Households in Three Stages of Transition. Michigan State University.
- Lopez, R. E. (1986). Structural models of the farm household that allow for interdependent utility and profit maximization decisions. *Agricultural Household Models-Extensions, Applications, and Policy*, 306-325.
- Lanjouw, J. O. & Lanjouw, P. (1997). The Construction of Poverty Lines: Methods and Assumptions. Mimeo, Yale University.
- Lanjouw, J. O., & Lanjouw, P. (2001). The rural non-farm sector: issues and evidence from developing countries. *Agricultural economics*, 26(1), 1-23.
- Lee, J. E. (1965). Allocating Farm Resources between Farm and Non-Farm Uses. *Journal of Farm Economics*. 47(1): 83-92.
- Leeuwen E. V, Dekkers, J. & Rietveld, P. (2008). The Development of a Static Farm Level Spatial Microsimulation Model to Analyse On- and Off- Farm Activities of Dutch Farmers. Paper for the 3rd Israeli- Dutch Regional Science Workshop, 4-6 November 2008, Hebrew University, Jerusalem, Israel.
- Leinbach, T. R., & Smith, A. (1994). Off-farm employment, land, and life cycle: transmigrant households in South Sumatra, Indonesia. *Economic Geography*, 273-296.
- Lim-Applegate, H., Rodriguez, G., & Olfert, R. (2002). Determinants of non-farm labour participation rates among farmers in Australia. *Australian Journal of Agricultural and Resource Economics*, 46(1), 85-98.
- Long, J. S., & Freese, J. (2006). *Regression models for categorical dependent variables using Stata*. Stata press.
- Malaysia. (Kuala Lumpur, Government Printers).
 _____. 1998. Third National Agricultural Policy, 1998-2010, Kuala Lumpur.
 _____. 1976. Third Malaysia Plan, 1976-1980, Kuala Lumpur
 _____. 1996. Seventh Malaysia Plan, 1996-2000, Kuala Lumpur
 _____. 2001. Eighth Malaysia Plan, 2001-2005, Kuala Lumpur

- _____. 2006. Ninth Malaysia Plan, 2006-2010, Kuala Lumpur
- _____. 2008. Economic Developments in 2008: The Malaysian Economy in 2008. Bank Negara Malaysia, Kuala Lumpur
- _____. 2011. Paddy Statistics of Malaysia, 2012, Kuala Lumpur
- Mantino F, Marini M. & Cecora J. (1993). Resource allocation in Italian farm households. In J. Cecora (ed) *Economic behaviour of family households in an international context-resource income and allocation in urban and rural, in farm and nonfarm households*. Publication No 295, Bonn: Society for Agricultural Policy Research and Rural Sociology.
- Martinez, S. W. (2002). "A Comparison of Vertical Coordination in the U.S. Poultry, Egg, and Pork Industries," *Agricultural Information Bulletins 33773*, United States Department of Agriculture, Economic Research Service.
- Meert, H., Van Huylenbroeck, G., Vernimmen, T., Bourgeois, M., & Van Hecke, E. (2005). Farm household survival strategies and diversification on marginal farms. *Journal of rural studies*, 21(1), 81-97.
- Mishra & Goodwin. (1997). Effect of Farm Income and Off-Farm Wage Variability on -Farm Labor Supply. *Agricultural and Resources Economics Review* 31/2 (October 2002): 187-199.
- Morgan, L. A. (1991). *After marriage ends: Economic consequences for midlife women*. Newbury Park, CA: Sage Publications, Inc.
- Nor Azni, A., Kamal, A. H., & Zakirah, O. (2014). Potensi Penerima Guna Inovasi Pertanian Di Kalangan Petani. *ICTOM 04 – The 4th International Conference on Technology and Operations Management* : pp. 161-168.
- Nor Hayati, S. (2011). Social Mobility Among The Coastal Community: A Case Study In Kuala Terengganu. *Kajian Malaysia, Vol. 29, Supp. 1, 2011*, pp 95–123.
- Newspaper list
- _____. Utusan Malaysia, 5th April 2014.
- Oshima, H. T. (1986). Off-farm employment and incomes in postwar East Asian growth. In *Off-farm employment in the development of rural Asia: papers presented at a conference held in Chiang Mai, Thailand, 23 to 26 August 1983/edited by RT Shand*. Canberra, ACT: National Centre for Development Studies, Australian National Univ., 1986..
- Oshima, H. T. (1985). Levels and trends of farm families' nonagricultural incomes at different stages of monsoon development. *Philippine Review of Economics*, 22(3 & 4).
- Pawel, B. (2006). Newly Industrialized Countries, Globalization and the Transformation of Foreign Economic Policy. *United Kingdom: Ashgate Publishing*. pp. 164. ISBN 0-75- 464638-6.

- Polzin, P. & P. MacDonald. (1971). Off-Farm Work: A Marginal Analysis. *Quarterly Journal of Economics*. 85(3): 540-45.
- Radam, A., & AbdLatif, I. (1995). Off-Farm Labour Decisions By Farmers In Northwest Selangor Integrated Agricultural Development Project (IADP) In Malaysia. *Bangladesh Journal of Agricultural Economics*, 18(2), 51-61.
- Raja. (2009). IADA North West Selangor.(Lecture) Ibu Pejabat IADA NWS. Department of Agriculture, Ministry of Agriculture and Agro-based Industry.
- Rabu, M. R., & Shah, M. D. M. (2013). Food and livelihood security of the Malaysian paddy farmers. *Economic & Technology Management Review*, Vol.8, pp. 59-69.
- Rao, M. K. (2000). *Rural Employment: The Non-farm Sector*. Deep and Deep Publications.
- Rozelle, S., Dong, X. Y., Zhang, L., & Hughart, A. (2000). Opportunities and barriers in reform China: Gender, work, and wages in the rural economy. In *ASSA Meetings, Boston, January*.
- Rigaux, P., Scholl, M. & Voisard, A. (2002). *Spatial Database with Application to GIS*. San Francisco, USA: Morgan Kaufmann Publishers.
- Terano, R. & Zainalabidin, M. (2011). Household Structure Among Paddy Farmers in the Granary Areas of Malaysia. *International Conference on Innovation, Management and Service IPEDR, Singapore*; 01/2011.
- Rivers, M. J. (1992). The contribution of women to the rural economy. (Technical Paper 92/4). Wellington, New Zealand: New Zealand Ministry of Agriculture and Fisheries Policy.
- Rizov, M. (2005). Pull and push: individual farming in Hungary. *Food Policy* 30: 43-62.
- Robinson, C., McMahon, P. J., & Quiggin, J. C. (1982). Labour Supply And Off-Farm Work By Farmers: Theory And Estimation. *Australian Journal of Agricultural Economics*, 26(1), 23-38.
- Rainin, R., & Mohd, N. (1998). *Sistem maklumat geografi*. Dewan Bahasa dan Pustaka.
- Satyanarayana, A. Thiyagarajan, T. M. & Uphoff, N. (2007). Opportunities for water saving with higher yield from the system of rice intensification. *Irrigation Science*, 25 (2): pp.99-115.
- Sexton, R. N. (1975). Determinants of Multiple Job-Holdings by Farm Operators, PhD thesis, Department of Economics and Business, North Carolina State University.
- Shand R.T. (1982). "Off-Farm Employment in the Development of Rural Asia: Issues". In *Off-farm employment in the development of rural Asia*, ed. R.T. Shand.

Canberra: National Centre for Development Studies, Australian National University.

Shand, R. T., & Chew, T. A. (1983). *Off-farm Employment and Its Impact on Farmers in the Kemubu Project in Kelantan, Malaysia*. Department of Industrial Promotion, Ministry of Industry and Development Studies Center, Research School of Pacific Studies, The Australian National University.

Shand, R.T. (1986). 'Agricultural development, non-farm employment and rural income distribution: a case study in Kelantan Malaysia', in Choe, YB. and Lo FC, (Eds.). *Proceedings of the International Seminar on the Role of Rural Industries for National Development in the Asian Region, Rural Industrialization and Non-farm Activities of Asian Farmers*, Seoul, Korea, 22-25 April 1985.

Siamwalla, A. (1996). Thai Agriculture: From Engine of Growth to Sunset Status. *TDMI Quarterly Review*, 11:4, 3-10.

Simons, R. (1987). Accounting control systems and business strategy: an empirical analysis. *Accounting, Organization and Society*, Vol.12(4): p. 357-374

Simpson, W., & Kapitany, M. (1983). The off-farm work behavior of farm operators. *American Journal of Agricultural Economics*, 65(4), 801-805.

Singh, S., Amartalingam, R., Wan Harun, W. S., & Islam, M. T. (1996, August). Simulated impact of climate change on rice production in Peninsular Malaysia. In *Proceeding of National Conference on Climate Change* (Vol. 4149).

Star, J., & Estes, J. (1990). *Geographic Information Systems: An Introduction*. Englewood Cliffs, NJ: Prentice Hall.

Sumner, D. A. (1978). *Labor Supply and Earnings of Farm Families with Emphasis on Off-Farm Work*, Ph.D thesis, Department of Economics, University of Chicago. University Microfilms Int., Ann Arbor, MI.

Sumner, D. A. (1982). X 'The off-farm labor supply of farmers', *American Journal of Agricultural Economics*, vol. 64, pp. 499±509.

Tai, S. Y. (1987). Labour allocation to farm and off-farm work by paddy households in Kemubu, Malaysia. *The Malaysian journal of agricultural economics*, 4, 1-17.

Taylor, D. C. (1981). *The economics of Malaysian paddy production and irrigation*. Bangkok: The agricultural development council.

The World Factbook 2013-14. Washington, DC: Central Intelligence Agency, 2013. Malaysia. Retrieved from:<https://www.cia.gov/library/publications/the-world-factbook/index.html> (Accessed 12th May 2014).

- The World Factbook 2013-14. Washington, DC: Central Intelligence Agency, 2013. [MalaysiaMap.gif.Noscale.Retrievedfrom:https://www.cia.gov/library/publications/the-world-factbook/index.html](https://www.cia.gov/library/publications/the-world-factbook/index.html) (Accessed 12th May 2014).
- Venkataratnam, L. (2001). Remote Sensing and GIS in Agricultural Resources Management. Proceedings of the 1st National Conference on Agro-Informatics, Dharwad, India, June 3-4.
- Walsh, S. J., Bilborrow, R. E., McGregor, S. J., Frizzelle, B. G., Messina, J. P., Pan, W. K., & Baquero, F. (2004). Integration of Longitudinal Surveys, Remote Sensing Time Series and Spatial Analyses. New York, USA: Kluwer Academic Publishers.
- Wiboonpong, A & Sriboonchitta, S (1999). The Role of Off-Farm Employment on Agriculture in Northern Thailand. Chiang Mai University.
- Woldehanna, T., Lansink, A. O., & Peerlings, J. (2000). Off-farm work decisions on Dutch cash crop farms and the 1992 and Agenda 2000 CAP reforms. *Agricultural Economics*, 22(2), 163-171.
- Wooldridge, J. M. (2010). *Econometric analysis of cross section and panel data*. Massachusetts: MIT press.
- Yassin, S. M., Shaffril, H. A. M., Hassan, M. S., Othman, M. S., Samah, B. A., Samah, A. A., & Ramli, S. A. (2012). The Quality of Life and Human Development Index of Community Living along Pahang and Muar Rivers: A Case of Communities in Pekan, Bahau and Muar. *Journal of Sustainable Development*, 5(6), p90.
- Zaim Fahmi, Bahaman Abu Samah & Haslinda Abdullah. (2013). Paddy Industry and Paddy Farmers Well-being: A Success Recipe for Agriculture Industry in Malaysia. *Asian Social Science*; Vol. 9, No. 3.