



Faculty of Technology Management and Technopreneurship

**A STUDY ON THE ACCEPTANCE FACTORS FOR SUSTAINABLE
FARMING TECHNOLOGY AMONG FARMERS REGISTERED
WITH FARMER ORGANISATION AUTHORITY MALAYSIA
(FOAM)**



Juan Rizal Bin Sa'ari

Doctor of Philosophy

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TECHNOLOGY AMONG FARMERS REGISTERED WITH FARMER
ORGANISATION AUTHORITY MALAYSIA (FOAM)**

JUAN RIZAL BIN SA'ARI

**A thesis submitted
in fulfillment of the requirements for the degree of Doctor of Philosophy**



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Faculty of Technology Management and Technopreneurship
UNIVERSITI TEKNIKAL MALAYSIA MELAKA

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2022

DECLARATION

I declare that this thesis entitled “A Study on The Acceptance Factors for Sustainable Farming Technology Among Farmers Registered with Farmers Organisation Authority (FOAM)” is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.



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APPROVAL

I hereby declare that I have read this thesis and in my opinion, this thesis is sufficient in terms of scope and quality for the award of Doctor of Philosophy.

Signature

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ASSOCIATE PROFESSOR DR. JUHAINI BINTI JABAR

Date

:

25 MAY 2022



DEDICATION

I dedicate this thesis to my parents Haji Sa'ari bin Hasan and Hajah Nurisah binti Haji Abu, to my in laws Haji Md. Buang bin Khalil and Hajah Asiah binti Parman and to my beloved wife Aziza binti Md. Buang, both of our children Jazraul Altaf and Jazbella Ayra.

I hope that this achievement fulfills the hope and the inspiration for our family.



ABSTRACT

Sustainable farming technology (SFT) is a farming system that is capable of maintaining farmers' productivity. It has captured the interest of developing countries and the numbers are growing as it relies on natural and human resources. However, farmers in Malaysia are still not familiar with sustainable farming. There is low awareness about SFT and the Malaysian agriculture sector has experienced a low adoption rate of SFT practices and indicates only a few farmers have accepted it. The aim of this study is to fill up the above-mentioned gaps by looking into acceptance of SFT among farmers registered with (FOAM). A quantitative methodology based on employing a structured questionnaire was used for data collection. The proposed research model and its hypothesis are tested using Partial Least Square (PLS-SEM) technique on a data set of 198 farmers registered under Farmers Organization Authority Malaysia (FOAM). Results showed that Facilitating Conditions are the most important factors in the structural relationship between exogenous and endogenous constructs. It is followed by Performance Expectancy, Effort Expectancy, Access to Finance, Government Support and Social Influence. Furthermore, the findings also indicated that Performance Expectancy, Effort Expectancy, Facilitating Condition and Access to Finance were found to have a significant influence on the acceptance of SFT among Farmers registered with (FOAM). However, Social Influence and Government Support were found non-significant influence to accept SFT among Farmers registered with (FOAM). Moreover, the findings indicate that Government Support moderates Performance Expectancy, Social Influence, Facilitating Condition and Access to Finance to accept SFT among farmers registered with (FOAM). However, only Effort Expectancy non-significantly related to being moderated by the Government Support. Theoretical, statistical techniques and managerial contribution of the study were explained as well as the implications of research to different levels, such as farmers and policy makers. The findings provide empirical evidence for the farmers to incorporate into their decision making. It will guide the farmers to accept SFT and how to further enhance its effectiveness and efficiencies. By having these results as guidance, it may be used as a comprehensive reference to guide future farmers so that they would have an improved knowledge and understanding towards SFT acceptance, and therefore, the SFT will be more efficient. The limitations of this study were discussed, as well as the recommendations for the farmers, policy makers and future researchers concerning additional variables such as mediating or moderating factors. Furthermore, future studies are also recommended to employ other types of instruments and include other statistical tests.

**SEBUAH KAJIAN TENTANG FAKTOR-FAKTOR PENERIMAAN TEKNOLOGI
PERTANIAN LESTARI DALAM KALANGAN PETANI-PETANI BERDAFTAR
DENGAN LEMBAGA PERTUBUHAN PELADANG**

ABSTRAK

Teknologi pertanian lestari (SFT) adalah sebuah sistem pertanian yang berupaya untuk mengekalkan produktiviti para petani. Ia telah menarik minat negara-negara membangun dan bilangan ini meningkat kerana teknik ini bergantung kepada sumber asli serta sumber manusia. Walau bagaimanapun, ia merupakan konsep yang agak asing bagi para petani di Malaysia. Kesedaran tentang amalan SFT masih rendah dan sektor pertanian di Malaysia kurang mengamalkan amalan teknologi SFT, menunjukkan ia hanya diterima oleh sebilangan kecil petani. Tujuan kajian ini dijalankan adalah untuk mengisi lompong-lompong yang disebutkan dengan mengkaji penerimaan SFT dalam kalangan petani berdaftar dengan Lembaga Pertubuhan Peladang Malaysia. Kajian ini menggunakan metodologi kuantitatif, berdasarkan soal selidik berstruktur untuk tujuan pengumpulan data. Model kajian yang dicadangkan dan hipotesis diuji menggunakan Teknik Partial Least Square (PLS-SEM) berdasarkan set data melibatkan 198 petani yang berdaftar dengan Lembaga Pertubuhan Peladang yang juga dikenali sebagai Farmers Organization Authority Malaysia (FOAM). Dapatan kajian menunjukkan Keadaan yang Mempermudah merupakan faktor yang paling penting dalam perhubungan struktural di antara konstruk dalaman dan luaran. Ia diikuti oleh Jangkaan Prestasi, Jangkaan Usaha, Akses kepada Kewangan, Sokongan Kerajaan, dan Pengaruh Sosial. Tambahan pula, dapatan juga menunjukkan Jangkaan Prestasi, Jangkaan Usaha, Keadaan yang Mempermudah dan Akses kepada Kewangan dikenal pasti sebagai mempunyai pengaruh yang signifikan terhadap penerimaan SFT dalam kalangan para petani berdaftar dengan Lembaga Pertubuhan Peladang Malaysia. Walau bagaimanapun, Pengaruh Sosial dan Sokongan Kerajaan telah didapati sebagai faktor-faktor pengaruh yang tidak signifikan dalam penerimaan SFT di kalangan petani berdaftar dengan Lembaga Pertubuhan Peladang Malaysia. Selain itu, dapatan menunjukkan Sokongan Kerajaan memoderasi Jangkaan Prestasi, Pengaruh Sosial, Keadaan yang Mempermudah, dan Akses kepada Kewangan untuk menerima SFT dalam kalangan petani berdaftar dengan Lembaga Pertubuhan Peladang Malaysia. Walau bagaimanapun, hanya Jangkaan Usaha dikenal pasti sebagai tidak berkaitan secara signifikan dan dimoderasi oleh Sokongan Kerajaan. Sumbangan secara teori, teknik statistik dan sumbangan pengurusan dijelaskan dan implikasi kepada kajian ini dalam tahap berbeza, seperti para petani dan pembuat dasar. Dapatan menyediakan bukti empirikal kepada para petani untuk mereka pertimbangkan dalam proses membuat keputusan. Ia akan membantu para petani untuk menerima SFT dan bagaimana untuk memperkasakan keberkesanan dan keefisienannya. Dengan dapatan ini sebagai panduan, ia boleh digunakan sebagai rujukan komprehensif untuk membantu petani di masa hadapan untuk mempunyai pengetahuan yang dipertingkatkan dan pemahaman terhadap penerimaan SFT, dan, dengan cara demikian, SFT akan menjadi lebih efisien. Limitasi kajian ini juga dibincangkan. Cadangan kepada para petani, penggubal dasar, dan pengkaji akan datang berkaitan pembolehubah tambahan seperti faktor pengantaraan. Seterusnya, kajian masa hadapan juga dicadangkan dengan menggunakan jenis instrumen yang lain serta menyertakan ujian statistik yang lain.

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CHAPTER 1

INTRODUCTION

1.1 Background of study

Farming has changed dramatically since 1945, the end of World War II. The rise of new technologies, mechanization, increased chemical use, specialization and government policies focus on how to maximize food production. The development of farming had many positive effects and reduced many risks. Even the smallest farmers can produce a mass number of farming produce but it comes with a price. The depletion of topsoil nutrients, water contamination, air pollution, greenhouse gas emissions, decline of family farms, neglect in terms of the way of living and working condition of farm laborers, threats to human health and safety; just to name a few.

Malaysia is the fourth largest emitter of greenhouse gases in ASEAN, behind Indonesia, Vietnam and Thailand, contributing to 0.52% of the worlds carbon emissions (Rahman, 2018). According to Rahman, 2018, climate change dan affect the biodiversity such as rivers, ponds, swamps and forest. It also affects the crops productivity and agriculture industry in Malaysia from the cause of drought, high temperature and air pollution. The Malaysian government is planning to cutdown the greenhouse emissions by 45% in the year 2030 through several initiatives and among them is introducing tax incentives to companies environmentally manage their emissions and planting trees since 2011 (The Star, 19 September 2016).

Sustainable Farming Technology (SFT) is a farming system that is “capable of maintaining their productivity and usefulness to society indefinitely. Such systems or technology must be resource-conserving, socially supportive, commercially competitive, and environmentally sound” (National Agricultural Library, 1999). SFT can also be defined from the 3rd Malaysian National Agricultural Policy (1998 – 2010), by the issues and challenges brought forward by the government showed the concerns for the environment at both domestic and global levels require more innovative and efficient sustainable technological agricultural and forestry practices for the sustainable development of the agricultural sector. The report also mentioned that the government is aiming for high productivity in the agricultural industry; while, at the same time, guaranteeing preservation and the use of natural resources such as agroforestry, biotechnology products, specialty natural products, bamboo and rattan, floriculture and aquarium fish on a sustainable basis. Several SFT practices and among them are permaculture, crop rotation, aquaponics, good livestock practices, good agricultural practices and good manufacturing practices.

SFT has captured the interest of developing countries and growing market demand because it depends on the natural and human resources available (Bhatta et al., 2009 and Florini and Pauli, 2018). It is more on a holistic approach for farming, as it depends on the ecosystem to ensure the crops are healthy and gave less harmful effects to the environment. It also has a lower environmental impact towards climate change, rate of biodiversity loss, nitrogen cycle, phosphorus cycle, stratospheric ozone depletion, global freshwater use and change in land use compared to conventional farming technology (Tuomisto et al., 2012).

According to Tiraieyari (2014) and Bujang and Bakar (2019), SFT is a new mechanism and the acceptance rate is still low among farmers. Some of the farmers have implemented such a system; however, it failed to achieve success since they lack knowledge

(Hu et al., 2012). They are not familiar with SFT and have poor technology acceptance due to poor business, governance, regulatory conditions, low educational levels and inappropriate infrastructure (Shaikh et al., 2018). It is essential to examine the acceptance factors of SFT among farmers. (Bigliardi, 2012; Uematsu and Mishra, 2012; Zhang et al., 2012). Based on their studies, Bigliardi et al. (2012) mentioned that farmers pursuing green innovation on their farms will meet environmental requirements and generate financial benefit at the same time. It will also enhance competitive advantage for their company and contribute to success to their green produce. Farmers who practice sustainable farming such as organic farming evidently mentioned by Uematsu and Mishra, 2012 are active in hedging risk and uncertainty derived from organic farming. They suggest further academic attention towards the farmers who decide to convert to a sustainable way of farming such as organic farming. Zhang et al., 2012 contend that it is necessary for farmers to consider the financial attractiveness when implementing sustainable farming or otherwise it will be ineffective. Sustainable farming techniques are needed, signifying that this technique is a promising practice for the farmers to achieve satisfactory economic interest with regards to the ecological condition (Zhang et al., 2012).

It has been studied throughout the previous years by several researchers from the European region (Sutherland and Darnhofer, 2012; Alba et al., 2012; Leifeld, 2012), North American region (Uematsu and Mishra, 2012) and South American region (Santos et al., 2012; Maffei et al., 2013), just to name a few. Based on studies being carried out in Europe Region, Sutherland and Darnhofer (2012) stated that sustainable farming products such as organic produce have higher economic value to compared to conventional farming produce. One of the examples of sustainable farming practices is crop rotation, which can have quite large impacts on production, natural resource consumption and pollutant emission (Alba et

al., 2012). Alba et al. (2012) also mentioned that decision made by farmers or land users must be based more on philosophies towards environmental concerns; for example, the use of pesticide and concerns towards the life of plants and animals that live in a particular habitat which is considered important to the environment. Organic farming has evidently helped the soil to easily absorb nutrients and have high efficiency or smaller maintenance requirements but this method requires further consideration of non-sustainable use of soil resources therefore additional and innovative method is needed (Leifeld, 2012).

As for studies being carried out in North America, Uematsu and Mishra, 2012 stated that farmers who adopt sustainable farming practices such as organic farming are actively hedging risk and uncertainty that result from organic farming. Further studies need to be considered towards the farmers deciding to convert to a sustainable way of farming. For the South American Region, Mafei et al. (2013) discovered that sustainable farming practices such as organic farming is an excellent alternative way to manage organic waste and provide benefits to plants and the soil. It also contributes towards improvement of soil quality for fruit production or any other produce most likely possible through sustainable farming and it is an excellent strategy for farmers to implement (Santos et al., 2012).

Though small in numbers, several local scholars have conducted studies towards technology and practices supporting SFT in Malaysia. For instance, Shahrudin et al. (2010a) and Shahrudin et al. (2010b) have conducted two studies to identify the consumers' purchase intentions towards organic food; nonetheless, the researchers did not cluster the consumers into proper segments nor focusing on farmer's acceptance towards SFT. Their results were based on 150 respondents have responded to the research survey showed that the consumers know what best for their health and will consume healthy food. According to a new report in 2019 by the Food Industry Asia (FIA) and a research firm IGD, almost 99

(per cent) of Malaysians are interested in maintaining a healthy diet and are actively trying to improve their consumption habits, however a significant majority (71 per cent) identified cost as a key barrier to achieving a healthy diet.

In addition, Tai et al. (2019) carried out a case study on Zenxin Organic Food Company and they believe the organic food trend will be more competitive and intense in the next decade. There will be an increment of local and foreign organic produce brands in the market. As for a study being carried out by Ahmad and Juhdi (2010), their study only focuses in the Klang Valley, which is located in the state of Selangor and their results indicate that consumers believed that organic food contain health benefits compared to conventionally grown food. However, only a small percentage is being identified regarding the progress of sustainable farming mainly in Asian countries (Yeong et al., 2012). Yeong et al. (2012) conducted a study and found out that the Malaysian vegetables sector have a low level of SFT adoption rate.

Only limited studies regarding SFT have been carried out in Malaysia. As farmers' tendency towards acceptance of SFT varies across countries and states (Hu et al., 2012; Patil et al., 2014), some studies need to be carried out at the local level. A study by Hu et al. (2012) indicated that in the chicken production system in China, their performance is more favorable than in Italy with regards to environmental load and overall sustainability. Comparably, a study by Patil et al. (2014), discovers that organic farming can be a sustainable farming practice in Karnataka, India depending on regional conditions. According to Tang (2019), Malaysia has established collaborations regionally and internationally in attempt to ease the farmers to adapt the impacts of climate change. The inconsistency of climate change regionally associated with Southwest Monsoon and the Northeast Monsoon gaining much attention in the study of climate trends and the

implications (Tang, 2019). Tang (2019) suggest effective implementation is needed through the development of policy and plans. Elements of Sustainable Development and Environmental Conservation components also should be included at the tertiary level (Tang, 2018). Therefore, they suggested that development of policies to enhance sustainable farming practices should consider the regional differences in order for it to be successful.

Studies on SFT need to be conducted to evaluate the acceptance factors that may set off the Malaysian farmers to implement green technology for business growth potential (Bakar et al., 2011; Martin et al., 2013). Additional studies were suggested to determine whether Malaysian's farmers are ready to accept these strategical changes from the conventional to sustainable technology.

Technologies used in SFT in Malaysia are still at its infancy, compared to countries such as Japan and Indonesia (Tai et al., 2019). Government agencies such as MARDI had found out that from the technologies used by these three different countries, Malaysia has the lowest yields (Tai et al., 2019). MARDI had identified the technologies being utilized by the Japanese farmers are on mulching and the use of fertilizers and as for the Indonesian farmers they are on the application of fertilizers in legumes (Tai et al., 2019). Malaysian farmers emphasize more on buffer zones the areas created to enhance the protection of a specific conservation area, often peripheral to it (Tai et al., 2019). They neglected the application of pest and diseases control technology that might affect the productivity of their farm (Suhaimie et al., 2016.) MARDI suggest that more SFT need to be explored and be transferred from the government agencies to our local farmers. An example of one of SFT is organic farming Asia is the major exporter of organic products and the number of countries is increasing (Willer and Lernoud, 2017). It has become a part of a legislative process that brought the enforcement of national and regional organic regulations to help facilitate

international trading and increasing number of governments began supporting organic agriculture beyond regulation, and there is a growing number of government policies and programs that support organic agriculture development, such as subsidy schemes, market development support, capacity building, and research investment (Willer and Lernoud, 2019).

It has contributed to socio-economic sustainability especially in developing countries such as Malaysia, Thailand, and Vietnam. In Malaysia, the agricultural industry contributes 7.1 percent or RM101.5 billion to the national Gross Domestic Product (GDP) in 2019, with oil palm (37.7%) followed by other agriculture including the agro-food sector (25.9%), livestock (15.3%), fishing (12%), rubber (3%) and forestry and logging (6.3%) (DOS 2019). The government realized the positive impact of achieving sustainable agriculture and slowly being adopted (<https://cleanmalaysia.com/2015/09/15/eco-farm-leads-the-way-for-sustainable-agriculture-in-malaysia/>). Sustainable agriculture system could bring higher income generation and has the potential in alleviating the poverty among the main actors in the food supply chain in Malaysia (Shariff, 2013). By imposing the National Standard through the Third National Agricultural Policy (1998-2010) for sustainable agriculture, the intention is not only to ensure conservation and utilization of natural resources on a sustainable basis but it also to motivate local farmers to participate in sustainable farming (Somasundram, 2016). The policy emphasizes to enhance food security, to increase productivity and competitiveness of the sector; to deepen linkages with other sectors; to create new sources of growth for the sector; and to conserve and utilize natural resources in a sustainable basis. This can be implemented throughout strengthening the land use by creating an integrated agriculture accentuating on agroforestry, mixed farming, rehabilitation of marginal land and proper soil and water conservation (Ahmad, 2001). As

for the improvement of the fertility of soil, hard work needs to be increased through promoting organic farming and use of organic matter, composting, conservation measures and production of organic fertilizers using the available agricultural waste in the farm (Ahmad, 2001).

The government also has addressed sustainable initiatives in the 8th to 11th Malaysian Plan (2010-2020) on improving environmental quality by undertaking climate change mitigation, adapting to its impact, and increasing efforts to conserve ecological assets. Among the initiatives are the enforcement of the Renewable Energy Act in 2011, to harvest solar, biomass, biogas and mini hydro on Malaysia's energy generation and it can be used on farm to replace other fuels or sold as a "cash crop" (Energy, R., 2009). Minimum Energy Performance Standards (MEPS) towards domestic appliances for sale or use for commercial purposes was also being gazetted in 2013 to ensure energy security and encourage to explore efficient and innovative technologies to gain competitive advantages without jeopardizing the environment (Salleh and Isa, 2019). The gazetted of EURO 4M standards in 2013, the use of RON97 in 2015 and to support implementation of biodiesel B5 Programme (5% biodiesel blending in automotive fuel) are among the sustainable initiatives by the government mentioned in the Eleventh Malaysian Plan. The conversion of empty palm oil fruit bunches, recycling activities, the (3R) Reuse, Reduce and Recycle programmes was strengthened and The National Biomass Strategy in 2020 utilising agricultural biomass waste was also among sustainable initiatives mentioned (Energy, R., 2009). Permanent Reserved Forest in the states of (Pahang, Perak and Selangor) and Green Technology Financing Scheme (GTFS) resulted the reduction of Green House Gas emission (Energy, R., 2009). Additionally, initiatives in the Northern Corridor Economic Region (NCER) developing training and certification programs for students and teachers to strengthen the regional