


TOWARDS ACHIEVING OF LONG-TERM AGRICULTURE SUSTAINABILITY: A SYSTEMATIC REVIEW OF ASIAN FARMERS' MODERN TECHNOLOGY FARMING BEHAVIOURAL INTENTION AND ADOPTION'S KEY INDICATORS

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ARTICLE INFO	ABSTRACT
<p>Article history:</p> <p>Received 04 October 2022</p> <p>Accepted 26 December 2022</p> <p>Keywords:</p> <p>Systematic Literature Review; Agriculture Sustainability; Modern Technology Intention and Adaptation; Asian farmer.</p> <div data-bbox="172 1025 475 1272" style="text-align: center;">  </div>	<p>Purpose: The objectives of this study to identify the indicator of factors make Asian farmer community influence towards modern technology farming practices and adaptation.</p> <p>Theoretical Framework: 11 of final recent literature had reported according to the eligibility and screening procedure which focus on</p> <p>Design/methodology/approach: using thematic analysis guided by ROSES 2018 to conduct systematic literature review. ROSES protocol as a guidance through five key methodological review processes that begins with identification screening using two eligibility databases namely Scopus and Web of Science. After formulating the research questions, quality appraisal and data extraction are done and the final process is analysis.</p> <p>Findings: From thematic analysis, this 11 of final review articles had identify six main themes 1) demographic indicator; 2) perception and belief indicators, 3) perceived awareness 4) technology acceptance indicators; 5) internal factor indicators; and 6) external factor indicators. From the six main themes, the review found another 33 sub-themes.</p> <p>Research, practical & social implications: There is a significant contribution into the body of existing knowledge and for practical implications. The findings explained the significant importance factors of technology behavioural intention and adaptation indicators to Asian community such as: 1) Listed factors may influence and transform the traditional agriculture into modern agriculture practices among Asian farmer community; 2) A government strategies and policy for strengthening future agriculture sector and 3) to recommend future direction for researcher in this area of study.</p> <p>Originality/value: The result had identified a growing number of literature on the factors can motivate and encourage Asian Farmer to adopt modern technology into their farming which can contribute the most importance to the government and policy</p>

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maker. Despite, ASEAN countries are still lagging behind advanced countries particularly in agriculture sector. Indeed, there were insufficient studies that systematically review the existing literature review on behavioural intention and adaptation of modern technology in Asia region. Hence, it's a need to review the existing of literature on factors influencing Asian Farmer in technology behavioural intention and adaptation.

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PARA ALCANÇAR A SUSTENTABILIDADE DA AGRICULTURA A LONGO PRAZO: UMA REVISÃO SISTEMÁTICA DA INTENÇÃO E DOS INDICADORES-CHAVE DO COMPORTAMENTO DOS AGRICULTORES ASIÁTICOS NA AGRICULTURA DE TECNOLOGIA MODERNA E NA ADOÇÃO

RESUMO

Finalidade: Os objetivos deste estudo para identificar o indicador de fatores fazem com que a comunidade agrícola asiática influencie as práticas e adaptações da agricultura de tecnologia moderna.

Estrutura teórica: 11 da literatura final recente tinham relatado de acordo com o procedimento de elegibilidade e triagem que se concentra em

Projeto/método/abordagem: utilizando a análise temática guiada pela ROSES 2018 para conduzir uma revisão sistemática da literatura. Protocolo ROSES como orientação através de cinco processos-chave de revisão metodológica que começam com a triagem de identificação usando dois bancos de dados de elegibilidade, o Scopus e o Web of Science. Após a formulação das perguntas de pesquisa, a avaliação da qualidade e a extração de dados são feitas e o processo final é a análise.

Descobertas: A partir da análise temática, estes 11 artigos de revisão final identificaram seis temas principais: 1) indicador demográfico; 2) indicadores de percepção e crença; 3) consciência percebida; 4) indicadores de aceitação de tecnologia; 5) indicadores de fatores internos; e 6) indicadores de fatores externos. A partir dos seis temas principais, a revisão encontrou outros 33 subtemas.

Pesquisa, implicações práticas e sociais: Há um significativo contribuição para o corpo de conhecimentos existentes e para implicações práticas. Os resultados explicaram a importância significativa dos fatores de intenção comportamental da tecnologia e dos indicadores de adaptação à comunidade asiática, como por exemplo: 1) Os fatores listados podem influenciar e transformar a agricultura tradicional em práticas agrícolas modernas entre a comunidade de agricultores asiáticos; 2) Uma estratégia e política governamental para fortalecer o setor agrícola do futuro e 3) recomendar direcionamento futuro para o pesquisador nesta área de estudo.

Originalidade/valor: O resultado tinha identificado um número crescente de literatura sobre os fatores que podem motivar e encorajar o agricultor asiático a adotar tecnologia moderna em sua agricultura, a qual pode contribuir com a maior importância para o governo e para a elaboração de políticas. Apesar disso, os países da ASEAN ainda estão atrasados em relação aos países avançados, particularmente no setor agrícola. De fato, não houve estudos suficientes que revisassem sistematicamente a literatura existente sobre intenção comportamental e adaptação da tecnologia moderna na região da Ásia. Portanto, é necessário rever a literatura existente sobre os fatores que influenciam o agricultor asiático na intenção comportamental e na adaptação da tecnologia.

Palavras-chave: Revisão Sistemática da Literatura, Sustentabilidade da Agricultura, Intenção e Adaptação da Tecnologia Moderna, Agricultor Asiático.

HACIA EL LOGRO DE LA SOSTENIBILIDAD AGRÍCOLA A LARGO PLAZO: UNA REVISIÓN SISTEMÁTICA DE LA INTENCIÓN DE COMPORTAMIENTO DE LOS AGRICULTORES ASIÁTICOS RESPECTO A LA AGRICULTURA CON TECNOLOGÍA MODERNA Y LOS INDICADORES CLAVE DE ADOCIÓN

RESUMEN

Propósito: Los objetivos de este estudio para identificar el indicador de los factores hacen que la influencia de la comunidad de agricultores asiáticos hacia la tecnología moderna las prácticas agrícolas y la adaptación.

Marco teórico: 11 de la literatura reciente final había informado de acuerdo con la elegibilidad y el procedimiento de selección que se centran en

Diseño/metodología/enfoque: se utilizó el análisis temático guiado por ROSES 2018 para llevar a cabo la revisión sistemática de la literatura. El protocolo ROSES como guía a través de cinco procesos de revisión metodológica clave que comienza con la selección de identificación utilizando dos bases de datos de elegibilidad, a saber, Scopus

y Web of Science. Después de formular las preguntas de investigación, se realiza la evaluación de la calidad y la extracción de datos y el proceso final es el análisis.

Resultados: A partir del análisis temático, los 11 artículos revisados identificaron seis temas principales: 1) indicador demográfico; 2) indicadores de percepción y creencia; 3) conocimiento percibido; 4) indicadores de aceptación de la tecnología; 5) indicadores de factores internos; y 6) indicadores de factores externos. A partir de los seis temas principales, la revisión encontró otros 33 subtemas.

Investigación, implicaciones prácticas y sociales: Existe una importante

contribución al conjunto de conocimientos existentes y a las implicaciones prácticas. Los resultados explican la importancia de los factores de los indicadores de intención de comportamiento y adaptación a la tecnología para la comunidad asiática: 1) los factores enumerados pueden influir y transformar la agricultura tradicional en prácticas agrícolas modernas entre la comunidad de agricultores asiáticos; 2) las estrategias y políticas gubernamentales para fortalecer el sector agrícola en el futuro y 3) recomendar la dirección futura para el investigador en esta área de estudio.

Originalidad/valor: El resultado ha identificado un número creciente de literatura sobre los factores que pueden motivar y animar a los agricultores asiáticos a adoptar la tecnología moderna en su agricultura que puede contribuir a la mayor importancia para el gobierno y los responsables políticos. A pesar de ello, los países de la ASEAN siguen estando por detrás de los países avanzados, especialmente en el sector agrícola. De hecho, no hay suficientes estudios que revisen sistemáticamente la literatura existente sobre la intención de comportamiento y la adaptación de la tecnología moderna en la región de Asia. Por lo tanto, es necesario revisar la bibliografía existente sobre los factores que influyen en la intención de comportamiento y la adaptación a la tecnología de los agricultores asiáticos.

Palabras clave: Revisión Sistemática de la Literatura, Sostenibilidad Agrícola, Intención y Adaptación a la Tecnología Moderna, Agricultor Asiático.

INTRODUCTION

In the era of the fourth industrial revolution (Industry 4.0), new technology adaptation such as Drone, GPS, remote sensing, IOT are relevant to use in agriculture activities. The world population is estimated to be about 9.7 billion in 2050, as such there will be great demand for countries to have the status of food security that is prominent in sustainable development goals. To increase the production, reduce the cost, reduce manpower, reduce high dependence of foreign workers, reduce reliance on imported food, and increase resource could be realised by technology adoption in agriculture, through various techniques adaptation in modern farming. Agriculture of any country provides food to the people that contributing to that economy (Jermittiparsert, Sriyakul, & Rodoonsong, 2013). Agriculture has emerged as an important income generator to the Gross Domestic Product (GDP's) of Malaysia and all countries over around the world. Since the economic crisis 2007 and Food crisis on 2010, a number of Asian countries including Malaysia have turned agriculture as one of their main income generators and consequently, with the current 2020 challenging time with pandemic of Covid-19, agriculture is expecting to be a main dominant penetration sector towards the economic contributor. This is because, in March 2020, Vietnam had stopped exporting their rice to Malaysia because they want to secure their domestic food for their people. Thus, agriculture should be the main agenda in Malaysia to secure our food in terms of Food stability

and Food Assess ability. Indeed, the identification the pattern of existing body of knowledge is relevant and in need for researcher, government and farmer through a develop comprehensive conceptual framework.

Sustainable Agriculture

The transformation of agriculture sector into a modern, viable and dynamic venture is led by the Malaysia's Ministry of Agriculture (MOA). The MOA is responsible for the modernization in agriculture activities and farmers' practices (Norazmi et al., 2020). The demand for sustainable agriculture is rapidly increasing due to the increasing growth of the population, technology transformation, stress on risk of environmental degradation, and to align with the people living of standard Sustainable agricultures imposed need the urged of innovation activities can help to protect environment, an increase the level of output and less depending on manual foreign worker in plantation. The Artificial Intelligent system has the ability to enhance the sustainability performance in all economic, environmental and social perspectives. Agriculture is seen an important sector contributor whereby it is aligned and the government carry it into the national development. Its help as a one of instrumental method to alleviate the Malaysia Economy and to bringing up the rural socioeconomics as well (Mosbiran et al., 2021). It is always be a main agenda in the 9th, 10th, 11th and 12th Malaysian Plan strategy to boost this sector by introduced and upbringing it into HIGH Impact Agriculture Program (HIP). These programs had achieved the objectives in improved the community quality of life, increase farmers income and offered young employment opportunity to near community (Shaffrill, et al., 2010) and less depending on young people migrate urban area to find job.

Modern Farming is one way to sustaining agriculture

Modern farming is known as Artificial Intelligent (AI), precision farming, Automation system, cloud computing and the modern technology as well. By having this, the agriculture output able to produce at more quantity and high quality of agricultural products. Modern farming involves the ability of technology to do the integration of information and communication technologies into machines, sensors, actuators and network equipment for use in agricultural production system. There are several technologies related to modern farming, including sensors, robotics, the Internet of Things (IOT), mapping or GPS, decision making, statistical and Big Data Analysis. Modern farming able to reduce the negative environmental impacts of farming, increases resilience and soil health, decreases costs for farmers, and expand across various the production system. Then, the quality of foods is improved, with less

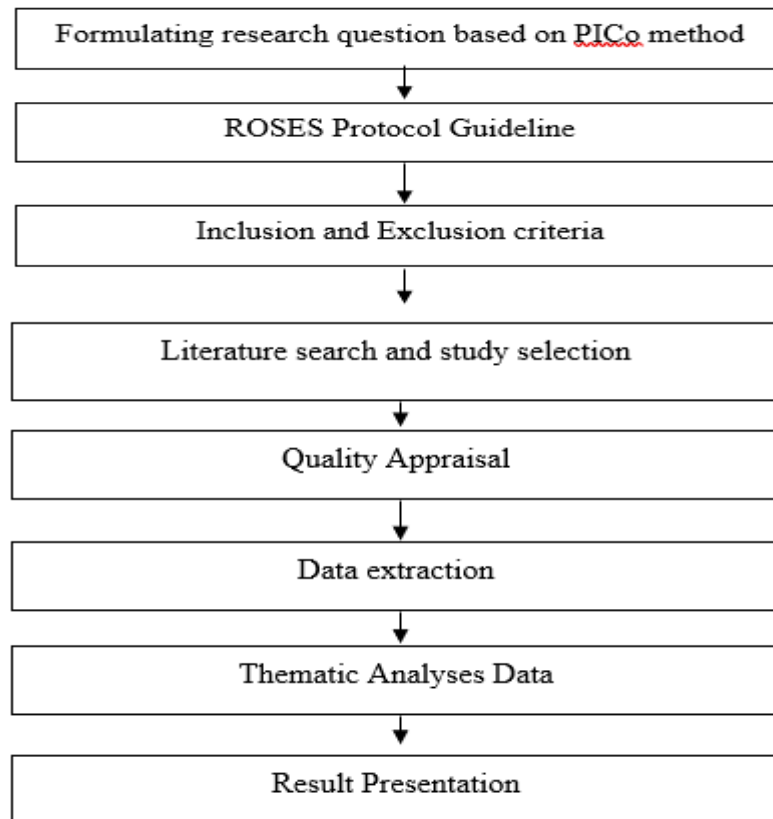
consumption of resources and less environmental degradation. The potential benefits of the smart farming are enhanced economic and environmental sustainability.

Modern Farming can be considered as one of the new agriculture activities in Malaysia. As in developed countries, smart farming had been practiced in agriculture sector, but according to Dr Ahmad Safuan bin Bujang, as Deputy Director of Smart and Precision Farming, 2019 from MARDI had mentioned that the modern farming is still new in Malaysia and it was estimated at approximately around 1% of Malaysia farmer had adopt this technology into their farming activities. A huge future potential the Malaysia farmers, Agriculture Institutional of Bodies and the Government should discover, mainly with the recent technology alignment. According to the Trilles et al., 2019, the food production is much relying with new technologies in farming have directly associated with economic condition of farmers. Farmer's socioeconomic status like age, level of education, culture, religion, agriculture production methods, income, friends pressure and societal values are affecting the farmers decision making process in having intention to adopt technologies in their farming activities (Bergfjord, 2013; Ahsan, 2011).

Towards a systematic review framework on Asian's farmers smart farming behavioural intention and Adaptation practices.

This study is using systematic literature review flow chart process by Ahh and Kang (2018) as a guide to review, find, identify and theme the construct focus on modern technologies farming adoption among Asian farmer.

Figure 1: Flow chart illustrating a systematic review (Ahh and Kang, 2018)



This paper emphasizes the three (3) systematic searching strategies are identification, selection and criticize appraisal any relevant research by collect, analyse and review the data from the previous research studies that this paper aims to see in Asian's farmers modern farming behavioural intention practices. This is known as a Systematic Literature Review is reviewing existing literature in more arranged and organized. A guidance protocol as a review step require to follow in review process. The process of categorizes, chooses and quality appraisal of previous studies can be responding to the formulated question (Dewey and Drahota, (2016). SLR techniques is begin with searching resource database through transparent and well-arrange organised process cross over many databases sources options. This searching strategy could enable researchers to formulate and respond to the research question (Xiao and Watson, 2019). The systematic review process use keyword, focus article on collect and select, theme and grouped it and thus, to analyse and summarise the result in the scope of studies by Higgins et al., 2011. Through this systematic review the idea by the authors can be identified, justified by find the gaps and lead to others researcher for future needed direction in the focus of study.

Despite of abundance of single studies, the study found out the technology adoption is very important for the developing and developed nations. So that, this systematically literatures studies focus on farmers behavioural intention towards smart farming efforts and by latest

review are still lacking. A recent systematically studies by the Adnan et al., (2019) found was entitled of adoption of green fertilizer technology among paddy farmers: A possible solution for Malaysian food security, the study was review and used combination economics and non-economics factors into her conceptual framework on specific focus on green fertilizer technology among Malaysian Paddy farmers. There were still insufficient number of systematically review of existing body of knowledge had focused on the behavioural intention adaptation indicators of smart farming in agriculture sector.

Meanwhile, this proposes systematically literature review attempts to fill the gap in understanding, and identifies and review of modern farming behavioural intention and adaptation indicator's pattern among Asian farmers from the all aspect namely 1) Demographic indicator; 2) behavioural norms indicators; 3) technology acceptance indicators; 4) micro factor indicators; and 5) macro factor indicators. Through the review of selected topic journal and report towards the farmer's behavioural intention in modern farming, its help to provides a general overview about the modern farming behavioural intention among farmers in Asian Region. Through systematically review on multiple recent previous scholars have put highly intention on many different behavioural intention and adaptation indicators such as Larson et al. (2020), Moglia et al. (2020), Man et al. (2019), Nabhani et al. (2016), Adnan et al. (2018), Akhtar et al. (2018), Adnan et al. (2017), Pipitwanichakarn et al. (2018), Danuri et al. (2019), Adnan et al. (2020) and Luong Tinh et al. (2019).

This study is very significant recently, with the new challenging of pandemic covid-19, it had tightened the world economy movement and mainly to agriculture sector. From the 3rd Quarter of the year 2020, Agriculture contribution to the economy had increased despite all others sector such as tourism, hotel and manufacturing had declined into the contribution of GDP. As we know, food demand among people keeps increasing due to its needy to human being and it would be persistent measure that agriculture would be a bright potential sector ahead into our National Agenda.

As far, there are lack of studies in new area that provide a holistic baseline on the status of modern farming behavioural intention adaptation among farmers in the Asian Region. So that, this study takes an opportunity to review a general insightful information towards the Asian Farmer in modern farming behavioural intention adaptation.

Additionally, this study is a vital and very significant to focus of Asian Region because as an emerging country that is expected to have experience imposition modern farming in Agriculture sector. Secondly, the growing role in global economy both in demographic and economic too. From instance, in demographic aspect, Indonesia with a population of over than

200 million, Philippines and Vietnam nation are about 90 million and in fact, 10 ASEAN's inhabitant is estimate represents about nearly 640 million of people. While in economic aspect, the impressive of economic growth, dynamic in global economic growth as the fifth-largest economy and had traded more than \$250 billion in goods and services. Thus, ASEAN region are relevant for further investigation on the potential behavioural intention and adaptation indicators of modern farming in agriculture sector in systematic way.

Hence, a study needs to explore the general understanding of Asian Farmers of behavioural intention towards modern farming to enhance resilience in Agriculture industry. Therefore, A study compile the details peer review literature among Asian countries and thus it is providing the opportunity in understanding on where the country to emphasis is and where attention needs to be placed and to be improved. To construct a current and relevant systematic review, the current article was guided by the **main research question** – What are the factors to make Asian farmers into modern farming intention and adoption. The main focus of the study on the perception and adoption indicators toward modern farming practices by Asian Farmers. The study aimed to gain more understanding to recognise, identify, describe and group a thematic pattern of modern farming adoption practices among farmer in Asian region.

METHODOLOGY

Reporting standards for Systematic Evidence Syntheses. (ROSES 2018).

ROSES protocol provides guidelines and statements to conduct a systematic review. It's allows searching from broad databases of scientific literature according to accurate search of terms. ROSES method provides high transparent guidance for systematic reviews of reporting to apply across all field of disciplines and variety of review subjects. Normally within the conservation and environmental management field. There is no limited restriction on others field to apply it compared to PRISMA guidelines specifically on health sector by Haddway et al., (2018). The earlier and middle stages of the review process begin with (1) searching, (2) screening, (3) data extraction and (4) critical quality appraisal. ROSES method by Haddway et al., (2018) is more flexible as a key of its strength. ROSES has extending for quantitative, qualitative and mix methods for synthesis in abstract. This guidance to help SLR development by controlling the quality, transparency of review synthesis and avoiding risk of bias.

To ensure the review synthesis process will in the right path, the process begin with formulating research question by using PICO method by Lookwood et al., (2015). Began with formulating research question refer to PICO technique which are 'P' for problem or population, 'I' for interest, 'Co' for context. Followed by three systematic screening phases; identification,

screening and eligibility and inclusion and exclusion criteria had been explained as follow. Cited by Hong et al. (2018), a quality appraisal of selected article process would be taken place after by main author, co-author, corresponding author and qualitative studies expert. Then, data extraction and data analysis for thematic synthesis process are conducted as guide by research question.

Research question formulation

There are three sources to drive and formulate this study which are, Firstly, based on the PICo concept by (Lockwood et al. 2015), the main research question of this study: what factors may Asian Farmer inhabitants as (population), agricultural sustainability on modern farming practices as (interest) and perceptions and adoption as (context). The combination of these keyword with symbol of search function such as phrase searching, wildcards, truncation and Boolean into two databased of Scopus and Web Of Science (WoS). Hence, the question is “What are the factors can make Asian farmer community towards modern technology farming practices”?

Secondly, the driven factors to formulate this research question is about the sustainable Development Goals (SDGs), also known as the global goals, were highlighted by United Nation Development Policy (UNDP) 2015 as a universal demand to protect the planet, environment by 2030 to ensure the world population had shared peace, happiness and prosperity. One of the SDGs that closely related to this study is about agriculture sustainability to ensuring food security are achieved through modern farming transmission in agriculture as one of sustainability Development Goals (SDGs) strategy.

Thirdly, the driven by previous research area was focusing in specific technology practices; for instance, Green Technology Fertilizer adoption among paddy farmer in Malaysia, also consider as an type of innovation technology into agriculture sector to boost the output yield had resulted by Adnan et al. (2019) and perhaps this Green Fertilizer Technology can be benefited to the farmers as well (K. Arai, O. Shige Tomi, Y. Miura, 2018; Srichaipanya et al., 2013). There is a synthesis literature review study had found the economic and non-economic category which cover on factors may influence Malaysia Paddy farmer to intend and adopt Green Fertilizer Technology practices. To that specific, there is a lack of existing of general understanding on modern technology practices in agriculture farming sector as a main domain of this systematic of review synthesis.

Three systematic searching process

Well-organized and highly-transparent of systematic literature review process are retrieve by three stages of process are: identification, screening and eligibility process, Shaffrill et al. (2021).

Identification

The first stage is the search process of keywords through PICO method: farmer community, behavioural and intention adaptation and modern technology practices and guided by formulated research question; What are the factors to make Asian farmers into modern farming intention and adoption. To expand this keyword, study enrich synonyms and related terms and variation from previous studies related topic based on the online thesaurus, dictionaries, search string created, keyword searched and found via Web of Science and Scopus database were started in May 2016 until December 2020 and opinion of expert after all relevant keywords managed to be determined. (see Table 1). This paper managed to retrieve a total of 213 articles from both databases in the first stage of systematic review process.

Electronic databases which are Scopus and Web of Science (WOS) were used to conduct literature searches to identify articles and as guide to record the review process. It also allows for rigorous search of terms related to Asian farmer's intention in adapting towards modern farming practices. Web Of Science (WOS) database poses many of journals and comprises of seven different citation databases including different information collected from journals, conferences, reports, books and book series. Scopus is the largest database existing on the market for multidisciplinary scientific literatures and it covers more than 49 million records including trade publications, open-access journals, and book series.

Web of Science (WoS) and Scopus databases (DBs) also are being chosen literature searches because there are two major and the most comprehensive sources of publication and impact indicators (Pranckute, 2021). Furthermore, Scopus is the best suited in research result's evaluation because it's provides wider and inclusive content. It is also having an individual profile for all authors, institutions, serial sources and interrelated to Scopus Databases make more ease, convenient and being practical to use. In the other hand, the weight of impact factor makes its better in quality references metrics to refer to. Scopus also is open to the society, free access and including impact factors metrics (Pranckute, 2021).

Manual searching process are guide by research question; main keyword search identified into databases search. The following search string found as stated as follows:

Table 1 – The search string used for the systematic review process.

Databases	Keywords used
Scopus	TITLE-ABS-KEY(("Agriculture" OR "Digital" OR "Smart" OR "Precision" OR "Technology" OR "Smart Farming" OR "Precision Agriculture" OR "Precision Farming" OR "Digital Farming" OR "Smart Agriculture" OR "Modern Technology" OR "Plant Monitoring" OR "Crop Monitoring" OR "Automatic Irrigation" OR "Smart Irrigation" OR "Hydroponic System" OR "Disease Detection" OR "Disease Analysis" OR "IoT" OR "Internet of Things" OR "Intelligent Agriculture" OR "Cloud in the Agriculture" OR "IoT Agricultural Applications") AND ("Intention" OR "behav*" OR "action" OR "acceptance" OR "motivation" OR "performance") AND ("Farmer*" OR "Farming Household*" OR "Primary Producers" OR "Landholder*" OR "Farming" OR "Farm Worker" OR "Agricultural Worker" OR "Small Hold*" OR "Small Scale" OR "Small Farmer*"))
Web of Science	TS = (("Agriculture" OR "Digital" OR "Smart" OR "Precision" OR "Technology" OR "Smart Farming" OR "Precision Agriculture" OR "Precision Farming" OR "Digital Farming" OR "Smart Agriculture" OR "Modern Technology" OR "Plant Monitoring" OR "Crop Monitoring" OR "Automatic Irrigation" OR "Smart Irrigation" OR "Hydroponic System" OR "Disease Detection" OR "Disease Analysis" OR "IoT" OR "Internet of Things" OR "Intelligent Agriculture" OR "Cloud in the Agriculture" OR "IoT Agricultural Applications") AND ("Intention" OR "behav*" OR "action" OR "acceptance" OR "motivation" OR "performance") AND ("Farmer*" OR "Farming Household*" OR "Primary Producers" OR "Landholder*" OR "Farming" OR "Farm Worker" OR "Agricultural Worker" OR "Small Hold*" OR "Small Scale" OR "Small Farmer*"))

Screening inclusion and exclusion criteria

Second stage is the process of screening duplicate articles manually by authors. As starting, a total of 12 duplicated articles were removed and 150 were screened based on several inclusion and exclusion criteria determined in this paper. Inclusion and exclusion criteria required include journal systematic review, book series, book, chapter in book and conference proceeding.

In addition, it focused on articles from 2009-2020 as the guided timeline which are adequate and sufficient period of time to see revolution of research. Perhaps, to have more published articles related. The more articles related found, the merrier review analysis result due to the research maturity consideration. According to Rayet et al (2012), the study also considers 10 years maturity of review articles as increase sustainable intensification of current level of production. However, only Eleven (11) final total article are related found and most of them are range between 2016 to 2020. According to Kraus et al (2020), the screening process on article published are between 2015 to 2020 to ensure in 'research field maturity'. So that it will consider sufficient to represent a review study. The 10 years criteria of articles screening are one of possible effort to have more articles related to review. In the other hand, modern technology practices in agriculture sector are new and it is about agriculture transformation revolution from traditional way into modern technique. As stated in the 2015 of world SDG's Goals implementation; modern farming practices is one of them to ensure food security and increase in agriculture productivity. Article journal with qualitative, quantitative and mixed methods were selected to review to ensure a potential diversify view and perceptions are

gathered. Article with high index impact in social science is included to expand acquiring more quality article related, articles published in English are chosen to avoid confusion languages and Asian farmers countries be study focused. Asian countries being selected; Malaysia, Thailand, Indonesia, Brunei Darussalam, Philippines, Singapore, Laos, Cambodia, Myanmar and Vietnam because Asian countries is the seventh largest economy in the world and it is region has remained as a region of growth, even global growth and trade slow down. It is showing the significant economy contribution of these Asian countries to the world performance. In fact, enormous of new technology has open the opportunities to Asian farmer community to aware and adopt it for benefit. Therefore, it is very important to review Asian technology agriculture studies and find the factors has influences technology adoption in their farming activities.

Overall, a total of 150 articles were excluded based on these inclusion and exclusion criteria. Finally, A total of articles screening is about 63 articles. (see Table 2).

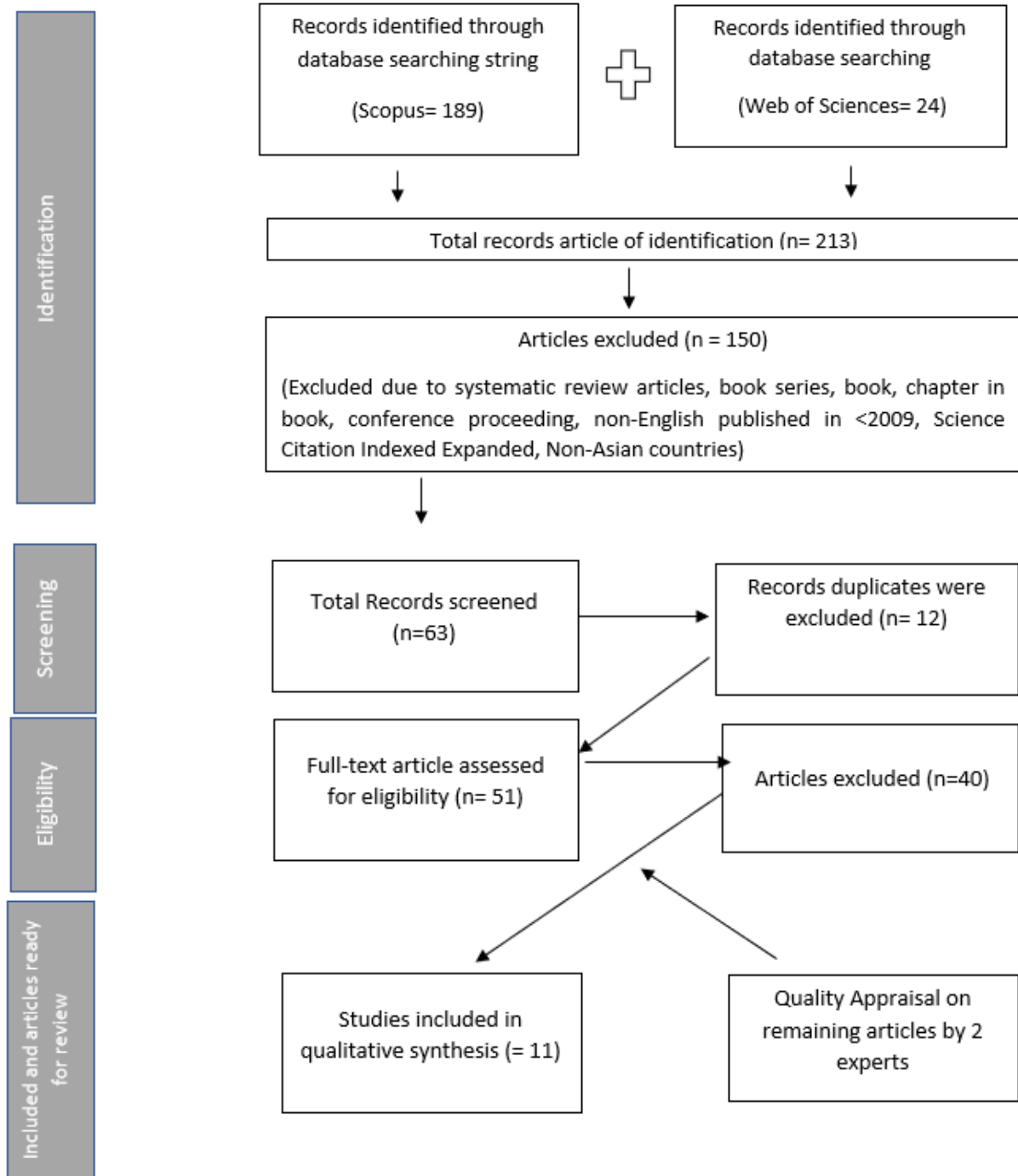
Table 2 - The inclusion and exclusion criteria.

Criterion	Eligibility	Exclusion
Literature Type	Journal (research articles)	Journal (systematic review), book series, (book, chapter in book, conference proceeding)
Language	English	Non-English
Time line	Between 2009-2020	<2009
Indexes	Social Science Citation Indexed, Emerging Sources Citation Index, Art and Humanities Index (Web of Science)	Science Citation Indexed Expanded (Web Of Science)
Countries and territories	Asian Countries	Non-Asian countries

Eligibility

Author and co-authors are involved on article discussion and selection, to ensure meet requirement of the intended objectives of this paper, the titles, abstracts, the entire content of each article were reviewed to fit in inclusion criteria. After process, a total of another 51 articles were excluded because the articles did not match specifically on inclusion intention in adapting towards modern farming adaptation by Asian farmers because the article diverse from modern farming topic, content and even different in abstract. Three (3) articles out of (51) articles were removed after full screening on paper, which focus on organization study and marketing aspect, and one (1) article was removed due to systematic literature review study. Overall, a total of 11 remaining articles is ready to be analysed (see Figure 1).

Figure 2 – The stages of review process adopted by (Shaffrill et al. 2021)



Quality Appraisal

Quality Appraisal is to evaluate the selected article from risk of biasness. It is to ensure that selected article is highly satisfied via measurement scale, tool and checklist. Mixed-Method Appraisal Tool (MMAT) allows appraisal of most common types of study methodologies and design namely, quantitative, qualitative studies, random, non-random studies and mixed methods studies by Hong et al. (2018).

Quality assessment on research methodology and analysis technique to address the research question through five main criteria assessments questions.

There are five (5) criteria assessment question of each type of category. Firstly, part of screening assessment question to assess are (1) appropriate and clear research question and appropriate data collection to address research question, (2) adequate data collection (3) adequate the interpretation of result and analysis (4) relevant strategy sampling (5) relevant measurement tool or statistical analysis. The details assessment criteria is explained in the table 3 as per below. In total, 8 articles fulfilled all criteria, 2 articles fulfilled at least four criteria, and 1 article managed to fulfilled at least three criteria (see Table 3).

Author and co-author were in mutual judgement making and independent in appraisal process. They read and review full articles to find consistency in methodology and analysis that guide by MMAT technique. Any disagreement answer replaced with discussion among authors and inviting experience expert to appraise and making quickly decision too. Each of article must be pass two part of screening question criteria checklist. Each of articles must be:

1. Responds two (2) part of questions
2. Choose the right types category of studies to appraise.
3. Tick (✓) or (X) into five (5) appropriate question criteria related and calculate the total score. Each of question assessment fulfilled answer with 'yes', 'no' and don't/can't tell. Half and more criteria fulfilled, out of 5 total of criteria are fulfilled the quality appraisal requirement (see on Appendix).

Data extraction and analysis

A growing of qualitative research needs a guidelines and tools to assist researchers to produce quality, rigorous and transparent research using thematic analysis. The thematic analysis method helps to process interpreting and representing data into positive contribution of qualitative research by Nowell et al., (2017). This study using inductive thematic analysis to develop theme and sub theme which are relevant to the main objective of study.

Highly flexible in thematic analysis can be able to fulfilled the need of many studies like different in research participants, similarities, differences and relationship to produce trust and accurate data by (Braun & Clarke, 2006; King, 2004). According to them, thematic analysis is useful analysis method for evaluate and summarise large set of data, well-structure in handling data and capable to produce transparent and well-organized reporting. The process of thematic analysis begins from identifying, analysing, organizing, describing, and reporting themes of qualitative, quantitative and mixed research method to present, interprets and

represents the large set of data. (Braun & Clarke, 2006; Nowel, 2017). Identify and notify the pattern of large existing of study by noticing the similarities, relationship and grouped the pattern of available data set. (Braun & Clarke, 2019). Begin with frequent reading (Kiger & Varpio 2020) of selected 11 articles, thus a compilation data via the similarities, correlated and relationship of the context being to extracted process. Then, researchers organized data and extracted data into relevant themes and sub-themes group guided by research question through inductive thematic analysis. The theme group process using coding method in nature and systematically. From this process, Six (6) main themes were found, which are: demographic indicators, belief and perception indicators, perceived awareness, technology acceptance indicator, internal factors and external factor. Repeating reading which has identify possible thirty-three (33) sub themes. Then, reviewing process with co-author in developing themes to make sure the main theme and sub-themes are match. Finally, the themes either main or sub theme were pass over to the two qualitative synthesis experts for the purpose of validation process. The main research question also has examined by expert as well.

The process of validation occurs between main author and co-author to discuss and developed theme in consistently. The idea or any puzzle can be related and associated with the interpretation of data. The contra and inconsistency idea in the theme process development had proceed with discussion until mutual agreement emerged. Two experts were review and validate the theme and sub theme which are from agriculture community expert and qualitative expert. They were help to review, clarified and to check the relevancy of each theme.

RESULTS

Background of the selected studies

A total of six articles out of eleven articles, these studies covered in Malaysia (Adnan et al. 2017; Adnan et al. (2018); Adnan et al. (2020); Man et. al (2019); Akhtar et al. (2018) and Danuri et al. (2019), two from Laos (Larson et al. (2020) and Moglia et al. (2020), one from Vietnam (Tinh et al. (2019), one from Thailand; Pipitwanichakarn et al. (2018) and one form Indonesia (Nabhani et al. (2016).

Meanwhile, the years of published paper between 2016 to 2020. There are three studies published in year of 2020; Larson et al. (2020); Moglia et al. (2020) and Adnan et al. (2020), three studies in the year of 2019; Adnan et al. (2019); Man et al. (2019) and Tinh et al. (2019); three studies also published in 2018; Adnan et al. (2018); Akhtar et al. (2018) and Pipitwanichakarn et al. (2018). There is one articles publish in year 2017; Adnan et al. (2017) and one articles published in year 2016 which is Nabhani et al (2016).

There are also different types of journal published such as there are two articles published in MdPI sustainability Journal; Larson et al. (2020) and Moglia et al. (2020); Land Use Policy about three articles published; Adnan et al. (2020); Adnan et al. (2018) and Adnan et al. (2017); the remaining articles published in different each types of studies such as one publish article in Scientific and technology research journal; Man et al. (2019); one article published in Asian Journal of Agriculture and rural development; Tinh et al. (2019); one articles in Asia Pacific Economy journal; Akhtar et al. (2018); one published article in science & technology policy management; Pipitwanichakarn et al. (2018); one article published in social science and humanities journal; Danuri et al. (2019) and one study published in Economics and Informatics journal articles; Nabhani et al. (2016).

There are the different research design represents by these eleven of selected articles. There are Six (6) Mixed method research articles journal which are; Moglia et al. (2020), Adnan et al. (2018), Adnan et al. (2017), Pipit et al. (2018), Adnan et al. (2020) and Tinh et al. (2019). One of Quality Assessment (QA) research study is Larson et al. (2020). Lastly, there are four (4) types of Quantitative research studies (Descriptive Study); Man et al. (2019), Nabhani et al. (2016), Akhtar et al. (2018) and Danuri et al. (2019). The infographic has explained the background of the selected studies as shown in the appendix.

The developed theme

Table 5: Summary of table thematic synthesis analysis

Main themes	Study	Main Variables Used
1.Socioeconomic Indicators	(Larson, 2020)	<u>Gender</u> Income, production choice, higher collaboration
	Moglia et al. (2020)	<u>Gender</u> Livelihood strategies, Future orientation, Openness to change, Education level, Literacy level, Economic outcome; Income and Reward .
	Nadia et al. (2020)	<u>Age</u> schooling, education level, experiences, level of knowledge.
	Tinh et al. (2019)	Age
2. Perception and belief Indicators	<i>Attitude, Subjective Norms and Behavioural Control</i>	
	Man et al. (2019)	Attitudes and social norms
	Nabhani et al. (2016)	Social influences

		Technology and information benefit
	Tinh et al. (2019)	Subjective norms and Perceived Behavioral control
	Adnan et al. (2018)	Direct and Indirect Attitude, Direct and Indirect Social Norms, Direct and Indirect Perceived Behavioural Control.
	Akhtar et al. (2018)	Farmer perception, Attitudes Subjective Norms
	Adnan et al. (2017)	Belief, Attitude and Subjective norms; (Individual ethical norms Personal moral norms, societal stress), and PBC.
	Adnan et al. (2020)	Attitudes Subjective Norms
3. Awareness	<i>Perceived Awareness on risk, economic, social and environment benefit.</i>	
	Tinh et al. (2019)	Farmer awareness: Risk awareness Environmental benefit awareness
	Nabhani et al. (2016)	Farmers awareness on: Technology benefit and Information
	Akhtar et al. (2018)	Farmers' awareness about climate change
	Adnan et al. (2017)	Awareness on economic friendly concern, Technology benefit and Environmental concern Role of environment
	Adnan et al. (2020)	Awareness of Environmental benefit Knowledge
4. Technology Acceptance Indicators	Pipitwanichakarn et al. (2018)	System Characteristics: (Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) Entrepreneurial Orientation (EO) <u>Mediating</u> -Trust
	Nabhani et al. (2016)	Perceived Usefulness (PU) Perceived ease of use (PEOU)
	Danuri et al. (2019)	<u>Main theme Factor</u> Technology factor <u>Moderating</u> IS element Work Farm design
	Adnan et al. (2017)	PU

		PEOU Technology adoption usage
	Adnan et al. (2020)	Innovation Attributes
5. Internal Factor		
	1. Entrepreneurial Orientation (EO); innovativeness, risk-taking (awareness), proactiveness and Trust.	
	Pipitwanichakarn et al. (2018)	Entrepreneurial Orientation Innovativeness, risk-taking and proactiveness Trust
	Nabhani et al. (2016)	Security & Safety and Convenient
	2. Interpersonal Communication Factor	
	Tinh (2019)	Interpersonal communication Factor
	Adnan et al., (2017)	Interpersonal Communication Factor
	Adnan et al., (2020)	Interpersonal Communication Factor
	3. Financial Manageability: Cost Perception	
	Adanan et al. (2020)	Financial Manageability: Cost Perception
	Tinh (2019)	Financial Manageability: Cost Perception
	Nabhani et al. (2016)	Financial Manageability: Cost Perception
	Moglia et al. (2020)	Financial Pressure
6. External factors Indicator		
	1. Environment factors: Government policy, role of government support.	
	Adnan et al. (2017)	Government Policy
	Adnan et al. (2020)	Government Policy
	Danuri et al. (2019)	Role of Government Government Support
	2. Communication Channel	
	Adnan et al. (2017)	Technology Aided Communication channel: Mass Media
	Tinh et al. (2019)	Communication channel: Television
	Adnan et al. (2020)	Communication channel: Television
	3. Internet Infrastructure, Network and Utilization	
	Nabhani et al. (2016)	Internet network
	Adnan et al. (2020)	Internet utilization

	Ting et al. (2019)	Internet accessibility

Main Variable (theme)

In this systematic review, a total of six factors of emphasizes internal or individual and external factors as the intention to adapt technology in farming among the Asian farmers. The six main indicators are demographic indicator, perception and belief indicator, perceived awareness, technology acceptance usage indicator, internal or individual indicator and external indicator.

Demographic Indicators

Demographic indicator had been involved in prediction of human behaviour in technology intention and adoption. There are two (2) main themes in systematic thematic group studies which is different gender in different technology adoption practices and age.

Demographic factors include age, gender as main theme groups while income, marital status, occupation and others demographic background related has considered as sub-sample variable. A total of 4 studies out of 11 studies emphasizes demographic studies as one of the behavioural intentions to adapt technology in farming among the Asian farmers by Larson et al. (2020) and Moglia et al. (2020). Both studies are main emerged on gender and income, while Moglia et al., (2020) had also focused on others variables such as education level, future orientation, greater openness, likelihood strategies, gender power relation factors and Nadia et al (2020) also have highlighted on main variable is age, and others variable like schooling, education level, experiences, level of knowledge while Tinh et al., (2019) discussed only about age of farmer.

Women have access to assets and information equally with men, and understand economic benefits of proposed actions, but the result found women are faster adopters of improved technologies and practices than men and they are earn of higher income than men due to women perceived higher collaborations (Larson et. al (2020). In addition, women in Laos also are more willing to change from traditional farming into modern technologies farming due to they were more active and dynamic with unexpected new externality (Moglia et al., (2020).

Even though, low education and low literacy amongst women indicate structural disadvantage because it limits their access to information and services. There is the gender-dynamic accepted strategies and their capacity to engage with modern markets. The

introduction of new technologies influences livelihood strategies and possibly gender reactions. In fact, the increasing debt also have associated with the adoption of new technologies leads to increase an agricultural output, to solve the labour shortage issues and it can be away to adopt of new practices by Luna et. al., (2020).

Adnan et al. (2020) studies focus on main demographic aspect of age of farmers indicator to adopt Green Fertiliser Technology (GFT). Age negatively affected farmers in management of paddy cultivation. Age is basis element in farmer's plan determination. Experience and education are two important factors to adopt the technology (Tey, 2013) too. Age also cannot be influence in inverse relation to VietGAP adoption. It is means that old senior age of farmer has not driven farmer behaviour on VietGAP adoption by Tinh et al., (2019). Youth has interest to explore more on technology than older generation.

Perception and belief Indicators

The Theory of Planned Behavior (TPB) was developed by Ajzen and Fishbein as an attempt to predict human behaviour (Ajzen, 1991). This theory explained that attitude toward the behavior, subjective norm, and perceived behavioral control influence through behavioural intention and action. It had been involved in prediction of human behaviour in technology intention and adoption.

There are 7 out of 11 articles studies emphasizes on behavioural studies to adapt modern technology in farming among the Asian farmers by Man et. al., (2019), Adnan et. al., (2018), Akhtar et. al., (2018), Tinh et al. (2019), Nabhani et al., (2016) and Adnan et. el., (2017) and Adnan et al. (2020).

Attitudes, Subjective Norms, Behavioural Control

Attitudes and social norms in Man et al., (2019) studies, both of factors are statistically significant predictors that influences farmers while the direct intention had also influence on technology practices that had expressing by actual behaviour of individuals and for smallholder farmers. The practices adaptation like cover cropping, resistant varieties, mulching, water management and extension service that aligned with information and adaption practice solve the false impression among smallholders. Moreover, current investigation by Man (2019) found that positive attitude, social norms on adaptation practices of oil palm smallholders with mediation role of intention towards climate change impact in Malaysia in Good Agriculture Practices (GAP) by surround a favourable approach from the farming community and well-information and training received to the smallholders, thus, lead the farmers being motivated to

involved in the agriculture farming. But the study found most of the farmers are lack in term of adequate information specifically from the NGOs and government guidance for farmers that possible to consider technology is ease to adapt for climate change by Akhtar et al., (2018). The studied had found that social pressure with friendly surround Indonesia cocoa farmer community were one of the most impacted factors on to perceived to use mobile phone. Social influences were recorded the highest mean than others factor Nabhani et al., (2016).

However, the same theme also by Tinh et al. (2019), the reputable people from government agencies is not statistically significant to the decision to adopt technology among street vendor, in fact, it was affected by others factor, the success farmers in the community to showed a positive relationship on social influence on farmer intention on VietGAP adoption. A positive attitude is the most important determinant followed by the subjective norm and the PBC by Adnan et al., (2018). Furthermore, attitude, subjective norms, perceived behavioral control and personal norm are positive effect to intention adoption among paddy farmer with a proper of communication strategies. However, personal moral norms were lower expectation than in the international standard and it's not applicable to Malaysian farmers. (Adnan et al., 2017).

The intention is significantly influence by belief, attitudes and norms. Individual ethical norm among paddy farmer is a progressive sign of their behaviour intention toward adoption. The addition by personal moral norms had been upgraded and explained by (Adnan, 2017; Arts et al., 2011; Long et al., 2011; Kaiser et al., 2003). The most significant factors is the importance of social pressure by others about environmental concern among farmers to influence the intention towards adoption of technology. Result from Adnan et al. (2020) studies focus on perception of paddy farmer on attitudes, subjective norms, Personal Norms, Perceived Behavioural Control shows are significant influence farmers into technology adoption. to adopt Green Fertiliser Technology (GFT) in their cultivation process. Social factor which includes family, investor, agriculture staff are well influenced and strong related on each other. The result in more positive attitudinal and behavioral outcomes than others on the adoption of Green Fertilizer (GFT) among Malaysian paddy farmers.

Perceived Awareness on risk, economic, social, technology benefit and environment benefit

Five out of eleven article had conducted on 'perceived awareness' about technology benefit, environment benefit, risk awareness about whether, price and technology brand, the variables which are involved in prediction of human behaviour in technology intention and

adoption. These studies are by Tinh et al. (2019), Akhtar et al. (2018), Nabhani et al. (2016), Adnan et al. (2017) and Adnan et al (2020).

There were four factors have influence farmer's intention to apply the VietGAP technology in Vietnam, one of them is risk awareness. Risk awareness about whether, pests, brand and price are the main reason for not applying the VietGAP. Risk awareness and behaviour on VietGAP adoption in vegetable production is inverse correlated. In the other hand, Farmer has a positively related about awareness on benefit environment towards high intention of VietGAP adoption. The more farmers understand and appreciate the benefit, the more they choose to apply the VietGAP standard. (Tinh al., 2019). Furthermore, Perceived susceptibility, perceived severity and perceived benefits of climate change are crucial role to raise farmers' awareness of climate change and formation favourable attitudes aim to reduce the adverse environment effect done by Akhtar et al., (2018). Another study found most of respondent intend to use mobile phone application to prefer gets the benefit on information and current technology. The easy and useful of mobile phone structure to user had trigger user's awareness about the benefit gain led them to adopt and accept this new mobile phone application. (Nabhani et al., 2016).

The intention to adoption depends on the awareness of paddy farmer on economic friendly concern and the technology benefit itself and it is a significant effect in sustainable Agriculture Sustainable. (SAP) had explained by Adnan et al., (2017) and knowledge, awareness of paddy farmer on environment benefit concern by farmers to adopt Green Fertiliser Technology (GFT) by Adnan et al., (2020). In addition, Nabhani et al., (2016) state that most of Indonesia farmer drive to intend to use the mobile phone application due to benefit of technology towards Indonesia farmer had influence them. Thus, the role of environment concern as one of the intentions to adapt technology farming by the Asian become main attention (Adnan et al., 2017).

Technology Acceptances to use Indicator

The Theory of Technology Acceptance model (TAM) as an attempt to predict human behaviour intention through the prediction on technology acceptance to use. This theory explained the main factors of Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) in modern technology acceptance.

There are 5 out of 11 articles studies emphasizes on modern technology acceptance to use among the Asian farmers by Pipitwanichakarn et al., (2018) and Nabhani et al., (2016), Danuri et al., (2019), Adnan et al. (2017) and Adnan et al. (2020), an accompanied with others

factors such as system characteristics such as IS element such as ease technology to us and work design is about number of event and activities, efficiency and innovation attribute are close related to each one.

Study by Pipitwanichakarn et al., (2018) was concluded that, there is a positive and significant on technology adoption and it is correlated in the process of decision making as perceived usefulness and perceived ease of use included to explain street vendor in Thailand on technology acceptance and adoption. That is the important indicator to adopt new technologies in Thailand. Study by Nabhani et al., (2016) is revealed that Perceived Usefulness and Intention to use (IU) are significant influences while the PEOU is insignificant. The most of respondent intend to use mobile phone application to prefer gets the useful benefit on information about current technology. The mobile phone structure of easy and useful to user would have high tendency of user to adopt and accept new mobile phone application and it's expected benefit use from it.

It's same goes to Danuri et al, (2019), technology factor was the most dominants factors to ICT usage. It is significant relationship of both moderator of IS and farm work design with technology factor to improve ICT usage. However, there is a insignificantly relationship between IS elements and farm work design for ICT usage among smallholder farmer in Malaysia. IS elements are main driver to moderating ICT usage for smallholder farmer in Malaysia. The correlation between technology factor and farm work design found also insignificantly in ICT usage. Adnan et al. (2017) also said about Perceived ease of use (PEOU) and perceived usefulness (PU) are not supported to the intention of SAP among paddy farmers in Malaysia. The researcher said there is not enough studies to calculating the indicator of farmers to adopt SAP technologies and there is no structural model to confirm the technology hypotheses formulated. In the other hand, a growing number of farmers are adopting new communication technology and using this for sustainable agriculture are allowing timely investigation in future.

In the other hand, from the systematic literature synthesis, the study found the innovation attribute is close related to the concept of technology acceptance usage, technology factor and system characteristics. They have similarities to motivate farmer to use technology. Innovation attribute: relative advantage, compatibility, observability, complexity and triability. It is a study by Adnan et al., (2020), the innovation attributes have impact paddy farmer's behavioural intention via the characteristics of technology such as: relative advantage, compatibility, observability, complexity, and triability to use Green Fertilizer Technology. Innovation can be well defined as other practices of concept and ideas.

Internal Indicators

Internal Indicator had been involved in individual prediction of human behaviour in technology intention and adoption. There are three (3) main themes in systematic thematic group studies which are main result on Entrepreneurial Orientation, Individual Factor, Interpersonal communication factor and Perceived awareness.

There are 5 out of 11 articles studies emphasizes on internal factor on adoption technology studies among the Asian farmers by Pipitwanichakarn et al., (2018), Nabhani et al., (2016), Tinh et al., (2019) and Adnan et., al (2017) and Adnan et., al (2020).

Entrepreneurial Orientation (EO); innovativeness, risk-taking (awareness), proactiveness and Trust

The research had highlighted entrepreneurial orientation elements include innovativeness, risk-taking and pro-activeness where hence entrepreneurial orientation is also an intention practice to adapt technology farming and in fact the result shows a relationship between entrepreneurial orientation and technology adoption. Entrepreneurial orientation is influence mostly and significantly by trust as reported in the studies conducted by Pipitwanichakarn et al., (2018).

High level of EO need a higher level of trust and vice versa. Means high risk of uncertainty without trust concern would effect the adoption. EO close related to the trust. However, EO is not directly significant influences to m-commerce. There were no past studies on mediation relation between EO and intention. Other researcher has also reported the positive impact of entrepreneurial orientation and business success also agreed by (De Clercq, 2010).

Trust is important indicator to adopt new technologies. Sharing information and minimise difficulties (ease of use) and gain benefit (usefulness) from service provider also known as 'trust' to user are important to influence them in adopting m-commerce. Trust is also an important predictor to take risk-calculate and due to that they need trust in order they are feel secure and safe. It is same study by Nabhani et al., (2016), to focused on individual factor such as security & safety and convenience of information and technology to adopt by Indonesia cocoa farmer has should consider them to intend of mobile use application.

Financial Manageability: Cost perception

Nadia et al. (2020) has investigated the perceived cost and adoption technology because it's considered about the factor of value of money, inexpensive, within farmer's budget and economical towards adopting Green Fertilizer Technology (GFT) practices. From the finding,

the GFT adoption is in slow trend among farmer due to price or cost factor on the technology. Farmer are need relying on public and private responsibility due to the cost of technology. Paddy farmer is sensible with price too (Tinh et al., 2019). Besides that, whether, pests, brand and price are the main reason for not applying the VietGAP. In fact, financial manageability is fundamental for paddy farmer.

While study by Nabhani et al., (2016) is to study focused on perceived cost on Indonesia cocoa farmer has consider to intend of mobile use application. Finally, the result found perceived cost is significant impact on technology adoption among Indonesia farmer. They prefer to gain benefit by availability of assess information in updating commodity price and technology as well. There is a positive relationship between cost perception, farmer gain benefit by availability of assess information in updating commodity price and technology as well. In the other hand, financial pressure may tend to require a further investment to increase agricultural productivity and outcome through new practices (Moglia et al.,2020).

Interpersonal Communication factor

In general, Tinh et al. (2019) did the study in Vietnam had revealed interpersonal communication factor is one of the internal related factors that definitely associated with farmers' behaviour on VietGAP adaptation through the frequent communicate with extension worker about agriculture technology. A positive significant statistically in communication effect on farmer intention on VietGAP adoption. However, communication is no longer become important when there is barrier in limited internet network, the driven by old age senior farmer and so on. (Tinh et., al (2019). The main important factor of a proper communication also had discussed by Adanan et al., (2017) which belief that interpersonal communications to give exposure to farmer in potentially in sustainable farming practices. And again, the interpersonal communication has positive impact paddy farmer's behavioural intention by Adnan et al., (2020).

External Factors

External factors had been involved in prediction of human behaviour in technology intention and adoption. There are three (3) main themes in systematic thematic group studies which are Environment factor on government policy, communication channel, and Internet Infrastructure.

There are 5 out of 11 articles studies emphasizes on macro factor on adoption technology studies among the Asian farmers by Adnan et., al (2017), Danuri et., al (2019), Nabhani et. al., (2016), Tinh et al. (2019) and Adnan et al. (2020).

Environment factors: Policy and govt policy, role of government support

Study conducted by Adnan et al., (2017) explained that policy factors in this paper is a form of Agro environment policy that play roles in the success or failure on intention to use technology farming especially toward Asian farmers. In Malaysia, government committed towards using sustainable agriculture method as it is a driving forces in agriculture policy. Government making an effort towards educating current farmers towards the new sustainable farming practices. Besides that, communication channels have to be aligned with government policy to support this communication channels delivering process and the main goal is for profit maximization through innovation adoption. The government policy is need to address into agriculture issue an accompanied with the increase level of socialization and communication related to farming. Besides that, the study found farmer relied on their salary in their plantation, not too much reliance on government sponsorships and money, thus it would result, farmer are more positive attitudinal and behavioural outcome explained by (Adnan et al., 2020).

In Malaysia, farmers also try to improve current and available technology in the markets and hence able to transform traditional business to agribusiness (Danuri, 2019). In response to this, technology is seen as an important aspect towards adaptation of technology farming among Asian. This era even prove that interaction of technology and other factors is also imperative because the other depending factors will also be affecting the technology such as environment. Environment factors most commonly shaped by government to provide the best surrounding of environment in the country. Environment Factor in a very significant influences on ICT usage and be a second dominant variable to influence ICT usage. (Danuri, 2019).

Communication channel, communication technology and technology aided communication

Study conducted by Adnan et al., (2017) explained that the communications channels for instance, mass media is actually to give exposure in sustainable farming practices. Paddy farmers attitudes to adopting Sustainable Agriculture Practices (SAP) are positive, one of main impacted factor is by technology-aided communications. Communication channels has to be align with government policy to support this communication channels delivering process and the main goal is for profit maximization through innovation adoption. Television is very

effective of communication channel favour by farmer to have updated information about current agriculture activities. A positive significant statistically relationship between communication effect on farmer intention on VietGAP adoption. (Tinh et al., 2019). Meanwhile, Adnan et., al (2020), consider the agriculture projects use Television to communicated are statistically significant. The recurrence staring at TV as communication channel, farmer able to disseminate agriculture information to them. In fact, communication behaviour variables were used as a variable for this study and found that training via TV are positively impact on farmer outcome to use Green Fertilizer Technology (GFT).

Internet Infrastructure; Internet accessibility and Network

The impact on adoption technology can improve business performance by extending the mobile internet network utilization. The strengthen internet network, infrastructure and government support are the elements the mobile phone structure are easy and useful to user. Thus, it will create awareness about the benefit gain in using it and led user to adopt and accept this new mobile phone application. (Nabhani et al., 2016). It was supported by Adnan et., al (2020) said that the agriculture projects use internet utilization are significant to encourage farmer to use Green Fertilizer Technology (GFT). However, limited internet accessibility has not headed farmer behaviour on VietGAP technology adoption. Thus, communication is no longer important to farmer (Tinh et al., 2019). In fact, communication behaviour variables were used as a variable for this study and found that training via TV and using internet utilization are positively impact on farmer outcome to use Green Fertilizer Technology (GFT).

DISCUSSIONS

Demographic Indicators

In summary, the different gender had different intention to practise the technology farming. It is depending on the resources, capabilities and opportunity of each people in farming activities. The result will react differently due to the individual capabilities and interest. In this case, even men pose huge opportunity and resources than women, women are faster in adopting modern technology in practices than traditional practices. According to Larson et al., (2020), Women in Laos, were faster to adopt of improved technologies and practices than men and they were a higher achiever in higher income than men in white rice farming. This is because their women have received higher level of collaboration and easy to tolerant, same stated in previous literature those women's higher propensity to collaborate have faster in adopting technologies Chatman et. al (2004); Herman et. al (2015) with equal amount of given of asset and

information between men and women by Laos government. There are sex differences in cooperation (Balliet et. al, (2011), Peshkovskaya et, al (2019) and it's remains inconclusive by Croson et, al (2009).

Meanwhile, Moglia et al. (2020) also found women in Laos are more willing to exit from traditional farming into more modern technologies farming. Initially through game approach, women were a slower adopter in farming, a contrary the expectations and gender stereotypes by Villamor et al. (2014). However, study found that female more actives and dynamic than men to responds into external opportunities. The outcome from this study had to give a dynamic and wider policy implications to the nation and Laos country. In addition, age being a one of factor to influence technology adoption practices in diverse way. Normally, senior farmer with have their limitation to adopt the new thing such as new technology compare to young people. Young people are more energetic, fresh, learnable, and it have high tendency to accept new knowledge and technology practices. According to Adnan et al. (2020), age, educational level of farmers are being indicator in demographic factors to adopt Green Fertiliser Technology (GFT). In fact, youth are more prefer fixed sustainability of paddy plantation that led farmer to use technology in their crop yield. A negative relationship between age and technology adoptions. Most of their farmer are in ageing generation which have a different characteristic, knowledge, need and perceptions on technology adoptions. According to Tey et al., (2013) farmers have different characteristics in terms of schooling, age and level of knowledge, they are making different in making adoption decision. It is shared the same result by Ruttan et al., (2000), where age of farmer is negatively relationship to the technology adoption. This is because older farmers are limited vision person and lack of interest in recent technology application in agriculture. Experience and education are two important factors to adopt the technology (Tey, 2013). Farm attributes likes varies of farm size also have different impact on technology adoption cause its beneficial to farmer (Knowler and Bradshaw (2007) and Feder and Umali (1993). Therefore, normally large farm community have a such a good innovation supported. The same result study by Tinh et al., (2019) also highlighted about an inverse relation between age and farmer behaviour on VietGAP adoption. Senior age farmer is not interested to explore more on technology information and usage than youth farmers.

Belief and Perception Indicators

Attitudes, Subjective Norms, Behavioural Control

Adoption of new technology influenced by an adequate level of knowledge, join in immediate family members and friends' group, experience and success farmer and confident

with own abilities, are able to encourage the technology adoption among them, that was supported by previous study (Borges et al., 2014). Farmers are normally easy to be influenced by the story of others farmers success in technology adoption to manage agriculture activities. In discussion, it would say that, social pressure can be explained from different perspectives. Some of farmers are perceived to use mobile phone, because of a positive surrounding people able to encourage them to use the mobile phone, assisted and disseminate the right technology information by agriculture worker and other farmers as well. However, reputable people from government sector and NGO sometimes did not being a significant indicator for farmer to use the technology due to their having their own role and other different task.

According to Man et al. (2019), the study to focus on (1) attitudes, (2) social norms and (3) intention as mediation factors were significant predictors of the technology adaptation practices. A favourable farming community adaptation practices are needed for farmers attitudes seems to be a significant predictor to embrace new sustainability technology farming that was supported by Larson et al. (2017). In the other hand, social norms had shown to have a significant important predictor to influence smallholder farmers on adaptation practices in Malaysia and it is aligned with A.S. Mase et al., (2017). Farmers' adaptation behaviours mostly influence from the ground and perceptible by neighbours that was in the same supported by A. Tripathi et al., (2017), farmers' friends, neighbours or other farmers are their main source of climate change impact of knowledge towards adaptation practices. The findings found positive relationship as well with intention in farmer's responses to address adaptation to climate impacts (J. G. Arbuckle et al., (2013).

Based on research result by Nabhani et al., (2016) had found that social pressure was found the one of the most impacted factors on to be perceived to use mobile phone adaptation. They were perceived mobile phone is helpful and usefulness in their farming activities. It was in same conclusion by previous studies by Khalifa and Shen (2008), Islam (2013), and Sadia (2011) in a study to investigate a massive growing of usage of social media application in Indonesia caused by social pressure. However, as Tinh et al., (2019) study, government support is not statistically significant to the decision to adopt it among farmer. It is inconsistent with Borges et al. (2014); Wauters et al. (2017); and Wauters and Mathijs (2013) are reported the intention to continue applying technology adoption of farmers is only influenced by reputable people. Farmers feel more confident to adopt the VietGAP through the success of other farmers by Tinh et al., (2019), and it's aligned with Laple and Kelley (2013); and Wauters et al. (2010) as a same conclusion. The result has positively associated with individual behaviour on VietGAP and it were consistent with the result found from the study by Dill et al. (2015);

Gebremariam (2001); and Makokha et al. (1999). A positive attitude can be shaped to farmer by equipping them with the benefit of innovation. Positive support community, encouraging facilities by agriculture sector are consider good social service on agriculture farming might motivate farmer to consider technology use in their farming. Full guidance between agriculture officer and farmer would help then adopt it by Akhtar et al., (2020).

Adoption is also affected by direct Attitude and direct PCB. Positive attitude and perceived ability among farmers influence their intention. The resulted by Adnan et al., (2018) studies done about direct attitudes, SN and direct PBC are significant and positively correlated to intention but not significant indirectly correlation to intention to adoption. Farmers are more likely to influence and do intend in their action when something gain beneficial and they surely to adopt in the future time that was supported (Williock et al (1999). Positive attitude result found by (borges et al., 2014; Garforth et al., 2006; Martinez-Garcia et al., 2013), and positive perceived ability by farmers influences their intention and there was significant relationship between direct attitude (when farmer see something beneficial, confident, social pressure perceived and direct PCB to intention. It was supported by Hansson et al (2012), psychological constructs influence farmers' decisions. Normative beliefs about referents farmers to have significant and positive correlation between indirect SN and intention for influence farmer's intention to adopt an innovation. A positive and significant correlation between direct PBC and intention shows that farmers' perceptions about their own abilities towards innovation adaptation.

According to Akhtar et al., (2020) study on favourable farmers' attitude had changed and formed it to control and minimize the climate change effect when farmer who are highly concern about environment in perceiving susceptibility, severity and benefit would increase farmers awareness to react in the favour attitude towards in technology adoption. The finding is consistent with by Bayard and Jolly (2007) which found a significant influence of perception of climate change on the attitudinal factors. This is supported by Le Dang, Li, Bruwer and Nuberg (2014) on the farmers perception of climate change, thus it was related to the behaviour. It is supporting by Masud et al. (2015) and Bayard and Jolly (2007) were a larger perception of susceptibility of soil degradation influences the farmers' awareness and attitudes towards environmental problems. Thus, the good farmer's belief and behaviour may help the country to minimize the impact of adverse effect of climate change. (Roger, 2011). So that, farmers need to reduce the negative impact for climate change by upgrading and change into behavioural intention and action to gain the benefit from technology adaptation practices.

From the different studies by Adnan et al., (2017) intention is significantly influenced by belief, attitudes and norms paddy farmers' intention towards the best SAP adoption practices in Malaysia. Individual ethical norm among paddy farmer is a progressive sign of their behaviour intention toward adoption (Adnan et al., 2017; Arts et al., 2011; Long et al., 2011; Kaiser et al., 2003). The addition factors by personal moral norms had been upgraded and explained, but the lower measured value in domestic than from international studies had reported by (Furnham and Telford, 2012). Thus, it's not applicable to Malaysian farmers. In the other hand, societal stress shows a vital role in changing the behaviour of farmer. Meanwhile, the subjective norms lead to individual moral norms to the intention towards adoption. In the discussion of Adnan et al., (2020) result, socio-psychological indicator be main focus of study on perception and belief through attitude, subjective norms, personal norms and perceived Behavioural Control have a significant influence them to technology adoption. While, social factor has strong influences to adoption via family, investor and agriculture staff. The final outcome was result positive attitude and behavioural action.

Perceived Awareness on risk, economic, social, technology benefit and environment benefit

Awareness on benefit environment often has high on adoption intention and behavioural action on adoption due to they too concern about environment benefit and put effort to reduce climate change effect. According to Tinh et al., (2019), risk awareness has inverse relationship to VietGAP adoption. It is same in the study by Akhtar et al., (2018), perceived susceptibility, severity and benefit of climate change may raise farmer's awareness on it and formed a positive attitude and had in minimizing its adverse effects. It was consistent by past studies by Bayard and Jolly (2007), found attitudinal factors were significant influence the perception of climate change. In addition, Le Dang, Li, Bruwer and Nuberg (2014) said farmer might making environmental improvement when they see there was an economic and social benefit that may lead by a greater change in their attitudes and perception towards climate change. The mediating effects between climate change awareness and attitudes towards climate change are consistent by study from Masud et. al. (2016) and Bayard and Jolly (2007). It's means the positive proper perceptions can change beliefs and change attitudes towards the action (Krunglanski and Stroebe 2005) and behavioural decision (McCown 2005).

Meanwhile, the paddy farmers have more concern towards the environment like the awareness of eco-friendly environmental benefits, they will more attraction towards adopting Sustainable Agriculture Practices (SAP) and Green Fertiliser Technology (GFT) by (Adnan et

al., 2017; Adnan et al., (2020). Farmer who are concern in reduce environment adverse effect such pollution, this is the good opportunities in using these improved technologies. Hence, the improved technologies help to reduce the environmental pollution. A concern regarding the environment does not depend also on behavior, which is confirmed by a study of Blok et al. (2015). Dienes (2015) proposed that environmental issues put forth an impact on a person's behavioral intention by beliefs, attitudes, and norms. In the other result by Tinh et al., (2019), farmers with environmental awareness who pay highly attention to the environment concern tend to apply clean farming methods (Läpple and Kelley, 2013).

To sum up, more farmer concern on environment such about the adverse effect on climate change and pollution impact, means farmers are aware to secure and control environmental issue getting the agriculture benefit then, and thus they are more likely to have tendency to adopt improves agriculture technology in their farming.

Nabhani et al., study (2016), also found most of respondent intend to use mobile phone application to prefer gets the benefit on information and due to current technology than competition in business environment. In the other hand, competitive pressure was significantly impacted to them to secure of any advantages in the business. The business environment factors is also influence in acceptance criteria of mobile phone application. The finding is same with Zhang et al., (2002).

Technology Acceptance Indicators

Normally, ease of use and usefulness are strongly giving an impact to the adoption behavioural intention. Besides that, with high trust from technology service provider and themselves and strong entrepreneurial orientation of farmers are making the tendency to adopt the technology is much higher. This is because both technology factor of ease of use and usefulness are not enough to contribute it, but somehow farmers also need to have feel of 'trust' to technology provider and their own self in conducting the new technology and they are really having a strong capable of entrepreneurial orientation as the intrinsic value of farmer have which not all farmer have that value.

According to that, study was covered Pipitwanichakarn et al., (2018) found that the technology acceptance model was a strongly predictive power among them that it is aligned with the past study by Faqih: Jaradat et., al. (2015). It was agreed by Lin et al., 2014; Karahanna et al., 2013 had also found that normally the user with high uncertainty (risk) would turn into higher intention to adopt m-commerce. The degree of usefulness of technology is based on how much the users perceive the ease of use. Both of them are important role in intention to

adopt m-commerce. Similarly, Nabhani et al. (2016) had found that perceived ease of use (PEOU) is positively influenced by cost perception and security & safety. It's confirmed by prior empirical studies (Khalifa and Shen (2008), Islam (2013), and Sadia (2011)). While other factors (cost perception, security and safety, and competitiveness pressure) are significant to Perceived Usefulness (PU). Due to its usefulness and not for competition which drive them to have intention in adopting the mobile phone application in order to get benefit on it. Perceived Usefulness (PU) significantly influences Intention to Use (IU), while Perceived Ease of Use (PEOU) is insignificant.

Furthermore, A study by Danuri et al. (2019) found that the most dominant factors to influence ICT usage among farmer is technology indicator with an accompanied of Information System (IS) elements as a technology is easy to use (PEOU) and farm work design as the content of work, task and activities as the Perceived Usefulness. It significantly influences ICT when both moderator IS and Work design at low level. There was supported by previous study on IS element as one of the common factors for consumer adoption and acceptance of the system said by Ali & Kumar, 2011; Sorensen et al., 2010; Uphoff, 2012). In the other hand, Adnan et al., (2017) also mentioned that Perceived ease of use and Perceived usefulness are not influence paddy farmers intention to adopt Sustainable Agriculture Practices (SAP) in Malaysia because there is no sufficient study and no structural model to confirm the hypotheses formulated. In fact, since the technology practices is new in agriculture and the growing numbers of farmers in adopting new communication technology in Malaysia because according to Hair et al. (2011), the result shows a weak and moderate relationship.

Besides that, Adnan et al., (2020), Innovation attributes such as relatives' advantage, compatibility, observability, complexity and triability have impact of paddy farmer intention to use Green Fertilizer Technology. Innovations involves individual attributes in creating and developing different techniques with the practical use of individual knowledge (Rogers, 2010). Emphasizing the appropriate innovation in cultivating network able to promise farmers will take part without hesitate and consistent presentation of innovation towards sustainable farming practices. This is supported by Bowman and Zibermen, 2013; Jaim and Akter 2012) stated that practical use of innovation are essential and crucial factor and provide better crop yield Shiferaw et al., (2011).

In short, most of farmer also convenient to use ICT when the level of difficulties and prefer benefit gain from technology at low level. Since farmer are from rural area and low of education level, they are not too familiar with technology skill. To that, government guidance in technology assistance about the usage are would help farmer to further positive impact in

using of technology. In fact, modern farming activities is still new, it is not much people aware and feel free to adopt it. Farmer need a time to explore, learn and need assisting help by responsible people from government. Finally, farmer need to consider a easy and benefit technology to accept and usage it, so that, farmer are more welcome new technology practices in forward time.

Internal Indicators

Entrepreneurial Orientation (EO); innovativeness, risk-taking (awareness), proactiveness and Trust

This research focuses on entrepreneurial orientation elements include innovativeness, risk-taking and pro-activeness on farmer intention practice to adapt technology farming. The factors of technology readiness and in fact the result shows a relationship between entrepreneurial orientation and technology adoption. Entrepreneurial orientation is influence mostly and significantly by trust as reported in the studies conducted.

Farmers with positive intrinsic value of entrepreneurial orientation would adopt the technology. Indeed, the elements of 'trust' as a mediating factor with Entrepreneurial orientation have given significant relationship to technology adoption. Trust is a crucial element to farmer because they want to feel secure, safe and convenience to use new technology and with who the service provider they refer to. This is because, it is involving huge investment money which the farmer need to consider to buy and use it. A strong positive entrepreneurial orientation and 'trust' responsible people are able to change farmer intention to adopt technology in their agriculture activities.

According to Pipitwanichakarn et al., (2018), trust is also highlighted as one of the intentions to adapt of modern farming by the Asian farmer. Trust is the most crucial part especially among Thailand people because the concept of high level of uncertainty(risk) will have high return only on those with well-known brand that was reported by Kao (2009) and Karahanna (2013). In the other hand, Entrepreneurial orientation is influence mostly and significantly by trust as reported in the studies conducted. Entrepreneurial orientation and technology adoption was related and connected each other in decision making through the trust were the same finding by Chong (2013); Faqih and Jaradat (2015). Trust is also an important predictor to expressing the m-commerce and the user believe it's too risky and due to that they need trust in order they are feel secure and safe.

It is supported also by Nabhani et al., (2016), to the result found it is significant impact on technology adoption among Indonesia farmer. The individual factor such as security &

safety or 'trust' and convenience of information and technology to adopt by Indonesia cocoa farmer has should consider them to intend of mobile use application. The same result from previous studies such as a specific industries like fashion or gadget (yu, 2013; swilley, 2007) in adopting the new technology. .In the other hand, the next individual factors like security and convenient and competitiveness pressure using the new technology have significant to farmer in adoption that have shared same result with Chen et al. (2013), Sadia (2011), Wei (2009), and Bigne et al. (2007).

Interpersonal Communication factor

Interpersonal communication among expert officer, friend and other farmers are important to internal value of farmers. This is because they would be able share and explore information, experiences and success 'story of other farmer. However, communication would not effective, if limited infrastructure like internet limited network occurs. There is a positive impact of paddy farmer behavioral intention and interpersonal communication.

According to Tinh et al., (2019), communication factor is one of the internal factors that definitely associated with farmers' behaviour on VietGAP. The more farmers communicate with their friends, neighbours, and agriculture officer or watch TV, the more likely they adopt VietGAP standard in vegetable production. The same conclusion and consistent with Dill et., al. Gebremariam (2001); and Makokha et al. (1999). The important of efficient communication also had studied by Adnan et al., (2017). A proper communication through technology-aided, farmer had potential to adopt a sustainable farming practice in positive way. It is same going to Adnan et al., (2020), interpersonal communication has positive impact towards paddy farmer's behavioural intention.

Financial Manageability: Cost perception and risk perception

There are positive and negative correlation between cost perception, risk perception and technology influences. Farmers are too sensitive with the price, expensive cost of technology, they would refuse to invest in technology. To that, they are would refer to the public and private sector to get help such as subsidies, grant and consultant service. Framer higher depend to responsible agency in public and private are a normally good effort from both sides, however, too much relied on them would not also to encourage because it will produce non-independent farmer in future. In the other hand, financial pressure among farmers would cause them in diverse way to use technology for increase agriculture crop and yield.

According to Adnan et al., (2020), Paddy farmer are highly responded to the price of technology. Price is crucial factor may influence how farmer able to adopt it because financial manageability is fundamental element to them. It was also supported by (Lienhoop and Brouwer, 2015). There is different cost perception from various farmer perspectives, in term of value of money, expensive technology, based on ability, economical and technology affordability that they should consider it. Due to that, farmer experiences to seeking and relying on public and private organization to assist them.

Refer to study by Tinh et al., (2019) too, the result found price are the main reason why farmer not apply the VietGAP Technology. Farmer also too sensitive with the price of communication technology. So that, it will affect the adoption of technology using in farming activities. As Wubeneh and Sanders (2006); and Ghadim et al. (2005) study also, the risks of weather, pests, and price can negatively affect this intention.

Same goes to Nabhani et al., (2016), individual Indonesia farmers depend on to the cost of mobile phone before decide to use and adopt it. There is a positive significant impact of technology adoption by Indonesia Farmer based on cost and benefit. Most of farmer are greater to have technology benefit than cost itself such as to update commodity price and current technology information use. Financial pressure is the one farmers' problem which urge investment spend for future on new practices to increase agriculture yield and output cited by (Moglia et al., 2020). Cost perception is about the cost or price of technology adoption such as the internet packages and smart phone price had done the same research by Islam (2011), Khalifa and Shen (2008), and Li et al. (2007). As a Moglia et al., (2020) mentioned, financial pressure among farmers would probably change farmer into new investment in technology to increase agricultural productivity.

External Indicators

Environment factors: Government policy, role of government and support

The role of environment factor is important to agriculture community such as any agriculture policy to encourage farmer in technology adoption and to ensure farmer are being educated in their agriculture transformation change into modern farming and improve the agriculture output. Indeed, Dissemination of government policy via effective communication channel aims to achieve the maximum profit. Furthermore, technology factor also has a positive significant to ICT usage among Agribusiness.

According to Adnan et al., (2017) in her study examined environmental factors, policy and government factors are the important roles in the Asian Farmer on modern farming

intention. Government committed towards using sustainable agriculture method as it is a driving forces in agriculture policy in technology adoption among agriculture farmer in Malaysia. The factor is very crucial toward productivity and profitability (Tey, 2013) because government also making an effort towards educating current farmers towards the new sustainable farming practices. However, some studies found that barrier to new farming practices is improper decision-making method between farmers (Hashim, 2017). Government policy in strengthening the technology adoption needs the communication channel to achieve the goals of profit maximization. The research also strengthening the important of role of environment as one attention factor to adapt technology farming among Asian. Danuri et al., (2019) in his study also concluded that environment factors had positively significant toward ICT usage towards Agribusiness. Environment factors most commonly shaped by role of government to provide the best surrounding of environment in the country (Danuri, 2019).

Communication channel, communication technology and technology aided communication

The effective of communication channel via Television is the most convenient medium of disseminate information to farmers. It is an aligned with government policy to educate farmer using effective communication method. Television is effective communication method prefer by farmers to influence technology adoption to get current information.

According to Adnan et al., (2017) explained that the communications channels include mass media and interpersonal communications to create awareness of farmer about sustainable farming practices. Farmers need to understand the needs and objectives of using this practice to ensure the success of efficient communication and cost-effective agricultural efforts (Borger, 2015). Positive impacted factor is by technology-aided communications is from effective government policy on positive paddy farmer attitude to change and adopt Sustainable Agriculture Practices (SAP). The paddy farmer's behaviour needs a proper communication of transmission medium in order to realise and gain benefit from SAP practice. Effective communication channel via Television which are the most favour by farmer to have current agriculture news and information by Tinh et al., 2019; Adnan et al., (2020). A positive relationship between communication and farmer intention to adopt the technology. training via television is positively impact on farmer adoption of Green Fertilizer Technology (GFT) by Adnan et al., (2020).

Internet Infrastructure; Internet accessibility and Network

The strong internet network utilization is able to help farmer to use mobile phone application in agriculture activities. It is significant encourage farmer to use and adopt technology and if the is internet barrier occur, the communication of farmer about current technology and agriculture updated information would break down. According to Nabhani et al., (2016), the strong internet network infrastructure may positively impact on technology adoption and may able to improve business performance. It is supported by Stoice et al., (2005) had mention that the government of Indonesia try to optimize the utilization of broadband for the benefit of farmer in Indonesia. Good internet coverage has significant influence farmer to adopt Green Fertilizer Technology Adnan et al., (2020). The role of communication will be not effective when internet is longer strong in utilization. Tinh et al., (2019).

CONCLUSION

In this Systematic Literature Review, we examined a total of 11 articles to identify the modern farming behavioural intention and adaptation indicators. The study motivated driven by lack of literature review of the indicator of modern farming behavioural intention and adaptation in systematically way and to investigate what factors are influence farmer to have intention to adopt technology practices in their farming. It is an align with the current need of efficient technology to produce food, able to feed the increasing of world population over the time and as a strategy for climate change management.

Modern farming practices is new in developing Asian countries compared to west countries. Hence, the study is very important to have the general picture and understanding about the behavioural intention and adaptation indicator among Asian farmers towards modern farming. Therefore, this research study is warranted among Malaysia and others Asian Countries. Indeed, the research finding is very important to identify the key indicators of Asian Farmer towards modern farming.

Based on the systematic review that has been conducted, several main themes and sub themes have been identified as key indicator of modern farming behavioral intention and adaptation. The indicators involved are Demographic, Behavioural intention and adaptation, technology acceptance usage indicator, internal factor and external factors. These modern farming indicators were further extended to 33 sub themes.

Significant of studies

The important implications studies for body of institutions and policy maker because technology adoption among farmers in agriculture sector is new in Asean compared to the west countries that are much technology aided in their agriculture sector. This systematic review has significantly contributed to the current body of knowledge. Indeed, one of the reasons is that to fill and extend the gap in the body of knowledge of indicators on modern farming intention and adaptation. Technology adaptation become an urge need for agriculture sector to help them in double production and able to secure food security for world population. Hope, the current model can give pretty sign and awareness to farmer and responsible institutions for strengthening the modern farming practices in agriculture sector. Therefore, the development of current model may complement the existing one.

Recommendations for future researchers

Firstly, there is an increasing trend on conducting studies on behavioural indicator and individual factor. However, from review of these several articles might be suggest the recommendations for future studies such as less attention on other area such as economic indicator, demographic indicators and technology acceptance indicator. This is showing the potential gaps in the literature that need to be fulfilled and to enhance the understanding of modern farming indicator among Asian farmer. The more indicators may discover by future researchers to extend the body of knowledge and this area of study would be more comprehensive.

Secondly, the area of modern agriculture study is keep embarking and attentionally by government from now onwards because this is very important sector to economy well-being. This research conducting using article review from WoS and Scopus Database only. Therefore, future research may consider reviewing article form different database such as from google scholars with more open, extending and comprehensive database. This would be empowered future researcher to find and develop more comprehensive study on modern Farming behavioural indicator among farmer that would produce better predictive and understanding.

New variables contribution

From the literature review synthesis process, new variables are found which is not have homogenous pattern variables with others previous of eleven (11) selected articles. There are:

1. Training like workshop, gathering and symposium had a positive impact on adoption of GF and large farm size would able to adopt the technology use compare to

small farm size due to large farm size have sufficient resources and capacity that have higher tendency to use, buy and adopt technology in farming activities by Adnan et al. (2020).

2. Product Differentiation is new variable as a moderator function, which are not investigate before. Vendor which offered high product differentiation would strongly effects of PU and intention. Product Differentiation strengthening a positive relationship between PU and m-commerce. Product differentiation will be under the next individual or internal theme studies. The existing of product differentiation makes more strengthen the positive relationship between perceived usefulness and intention to use mobile commerce by Pipitwanichakarn et al., (2018).

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Appendix

Table 3: The Methodological and Analysis Assessment Criteria

Research Design	Assessment criteria
Screening question (for all types)	S1: Are there clear research question? S2: Do the collected data allow to address the research question?
Qualitative	QA1 – is the qualitative approach appropriate to answer the research question? QA2- Are the qualitative data collection methods adequate to address the research question? QA3- Are the findings adequately derived from the data? QA4- is the interpretation of results sufficiently substantiated by data? QA5- Is there coherence between qualitative data source, collection analysis and interpretation?
Quantitative randomized controlled trials	QA1- Is randomization appropriately performed? QA2- Are the groups comparable at baseline? QA3- Are there complete outcome data QA4- Are outcome assessors blinded to the intervention provided? QA5- Did the participants adhere to the assigned intervention?
Quantitative (descriptive)	QA1- Is the sampling strategy relevant to address the research question? QA2 – is the sample representative of the target population? QA3- Are the measurement appropriate? QA4- Is the risk of nonresponse bias low? QA5 – Is the statistical analysis appropriate to answer the research question?
Quantitative (non-randomised)	QA1- Are the participants representative of the target population? QA2- Are the measurement appropriate regarding both the outcome and intervention (or exposure)? QA3- Are there complete outcome data? QA4- Are the confounders accounted for in the design and analysis? QA5- During the study period, is the intervention administered (or exposure occurs) as intended?
Mixed methods	QA1- is there an adequate rationale for using a mixed methods design to address the research question. QA2- Are the different components of the study effectively integrated to answer the research question? QA3- Are the outputs of the integration of qualitative and quantitative components adequately interpreted? QA4- Are divergences and inconsistencies between quantitative and qualitative results adequately addressed? QA5- Do the different components of the study adhere to the quality criteria of each tradition of the methods involved?

Source: Hong et al. (2018)

Table 4: Result of Quality Assessment

Study	Research Design	S1	S2	QA1	QA2	QA3	QA4	QA5	Number of criteria fulfilled	Inclusion in the review
(Larson, 2020)	QA	√	√	√	√	X	X	√	3/5	√
Moglia et al. (2020)	MX	√	√	√	√	X	X	√	3/5	√
Man et al. (2019)	QN (DC)	√	√	√	√	√	√	√	5/5	√
Nabhani et al. (2016)	QN (DC)	√	√	√	√	√	X	√	4/5	√
Adnan et al. (2018)	MX	√	√	√	√	√	X	√	4/5	√
Akhtar et al. (2018)	QN (DC)	√	√	√	√	√	√	√	5/5	√
Adnan (2017)	MX	√	√	√	√	√	√	√	5/5	√
Pipitwanichakarn et al. (2018)	MX	√	√	√	√	√	√	√	5/5	√
Danuri et al. (2019)	QN (DC)	√	√	√	√	√	√	√	5/5	√
Adnan et al (2020)	MX	√	√	√	√	√	√	√	5/5	√
Tinh et al., (2019)	MX	√	√	√	√	√	√	√	5/5	√

QA = Quality Assessment; QN (DC)= Quantitative descriptive; QN (NR)= Quantitative non-randomised; QL= Qualitative; MX= Mixed-Method; C= Can't tell.

Figure 3: The location of Asian Article Journal conducted

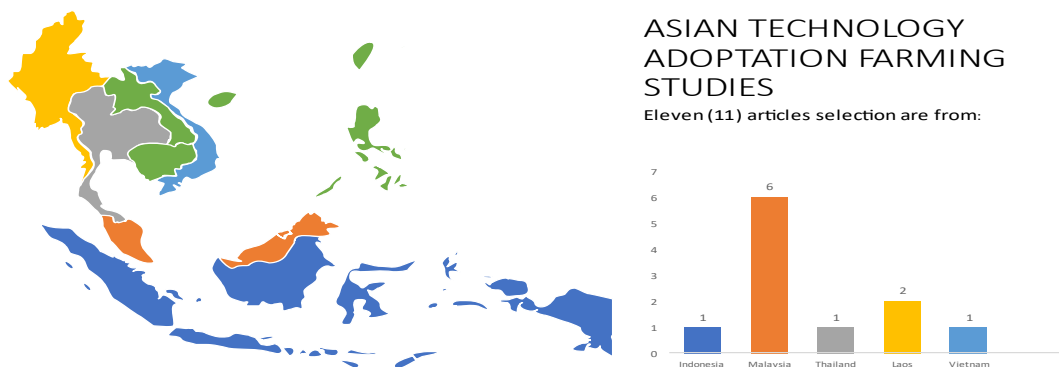


Figure 4: Year Published of 11 selected journal articles.

YEAR PUBLISHED OF 11 SELECTED JOURNAL ARTICLES

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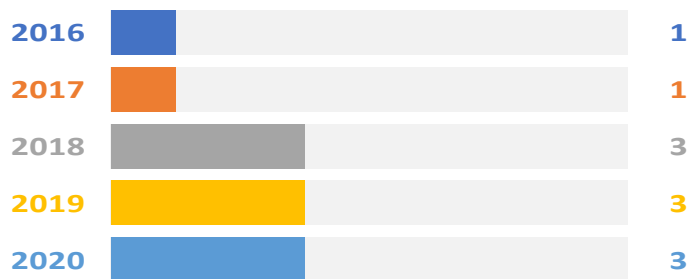


Figure 5: Types Of Journal Articles Published

TYPES OF JOURNAL ARTICLES PUBLISHED

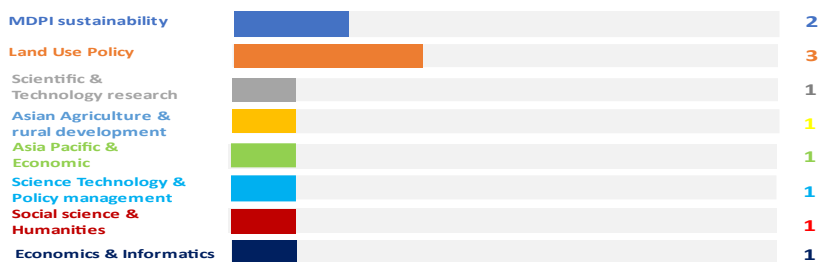


Figure 6: Types of Research Design

TYPES OF RESEARCH DESIGN

