EFFECTIVE AGROTECHNOLOGY IMPLEMENTATION TOWARD CROP HARVESTING IMPROVEMENT

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The thesis is submitted in partial fulfilment of the requirement for the award of bachelor's degree of Technology Management (Innovation) with Honours.

FACULTY OF TECHNOLOGY MANAGEMENT AND TECHNOPRENEURSHIP
UNIVERSITI TEKNIKAL MALAYSIA MELAKA

JUNE 2022

SUPERVISOR AND PANEL DECLARATION/APPROVAL

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this thesis and this thesis are adequate in terms of
scope and quality which fulfil the requirement for the award of
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DEDICATION

Every challenging task requires sacrifices, self-effort, strength from God Almighty as well as my beloved families. To the Almighty Lord our God, respected lecturers, families and good friends who provided their knowledge and time to guide me in completing this thesis.

ACKNOWLEDGEMENT

I thank God that I have been given the chance and strength to finish this thesis. Without Him I will never have the chance to complete this Final Year Project successfully. Finishing this Final Year Project costed me blood, sweat, and tears in mentally and emotionally. I also would like to express my gratitude to my supervisor Dr. Kamarudin Bin Abu Bakar who gave his best and guiding me while finishing this study making this work possible.

This study and effort are wholehearted dedicated to my parents and family especially my mom Susila Edward. My family has been supporting me and continually providing me who always motivate me in completing this thesis. Their prayers that had been blessing all my journey from the beginning until the end of my study for this bachelor's degree.

Finally, I also would like to dedicate my gratefulness to my friends who are always there to share their words of advice and encouragement to finish this thesis. There are many guidelines that I am not sure and they are always there to help me when I need it.

ABSTRACT

Agrotechnology has been known for many years but a are so many people that do not know about it or know about the benefits for implementing it in their farming activities. The researcher believes that agrotechnology can bring so much benefits to farmers as long as they are willing to learn about it. This agrotechnology can give the opportunity to people in Sabah to explore the world of entrepreneurship and gain more income since there are limited job opportunity there. The objective for this thesis is to examine how farmers get to the maximum production of their yields, to determine whether farmer's labour cost will be much easier with the technology implementation and finally to determine what benefits farmers will get from implementation agrotechnology. The independent variable in this research framework is make job easier, IoT and management efficiency while for dependent variables are better output, simplify activities, continuous supply, shorter time and increased shelved life. The methodology that researcher uses for this thesis is quantitative method and the researcher used Krejcie and Morgan (1970) in order to determining the sample size, Therefore, the sample size that the researcher use to obtain the data was 849 individuals. For the data analysis researcher uses descriptive analysis, reliability analysis, Pearson Correlation analysis and linear regression analysis to analyse the data.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

This chapter will include the information about the effective agrotechnology implementation toward crop harvesting improvement in Sabah. Researcher will explain about how agrotechnology help to make improvement in crop harvesting. Researcher also believe that this research will help the people in Sabah to be more knowledgeable about the importance of agrotechnology implementation. This chapter discusses about the background of study, problem statement, research questions, research objectives, significance of study and scope of study.

1.2 Background study

1.1.2 Agriculture

Agriculture has long been acknowledged as playing a critical role in development. Agriculture was recognized as a source of contributions that helped induce industrial progress and a structural change in the economy in the primary study on the subject. (D. Byrlee, A. De Janvry, and E. Sadoulet, 2009). Agricultural production and productivity have changed dramatically in the last 50-100 years, owing in large part to governmental and private expenditures in agricultural research, with far-reaching repercussions (Alston, Julian M., and Philip G. Pardey. 2014) The art and science of cultivating the land, growing crops, and raising livestock are known as agriculture. It entails preparing plant and animal goods for human consumption as well as their delivery to markets. Agriculture is responsible for the majority of the world's food and textiles. Agricultural items include cotton, wool, and leather. Wood for building and paper goods are also provided by agriculture. These goods, as well as the agricultural, practices utilized, may differ from one region to the next. (The art and science of agriculture, Society, 2011) Agricultural chemistry includes the use of chemical fertilizers, insecticides, fungicides, soil composition, agricultural product analysis, and farm animal nutrition. The green revolution began in the Western world and extended many of these advances to farms all over the world, with varying degrees of success. Hydroponics, plant breeding, hybridization, gene modification, better soil nutrient management, and enhanced weed control are some of the other recent improvements in agriculture. Crops with capacities beyond those of naturally occurring plants, such as increased yields and disease resistance, have resulted through genetic engineering. Because modified seeds germinate faster, they may be planted over a larger area. (ScienceDaily,2021)

1.3 Agrotechnology

Agrotechnology is the combination between the technology and agriculture where the agrotechnology knowledge is growing every year. The agrotechnology is purposely to make the crops and plants to grow much faster and give the farmers to have the maximum yields production in better way and easier way and less time taken for harvesting. Harvesting is the process of collecting the plant's usable portion or pieces after all of the elements have matured and the consumable sections have acquired the right maturity level. Harvesting occurs 10 to 15 days after the seed has attained fruit maturity. It entails cutting, gathering, and conditioning bioenergy to prepare them for later activities. (Mathanker, S. K., & Hansen, A. C. 2014). According to RP Thompson (2011) technology able to reduce the impact to the environment and did not effect the supply of food, price and consumers health.

Agrotechnology also give the farmers benefits in terms of water management where agrotechnology can ensure adequate water supply to the plants because the water will be supply automatically to the plants. using sophisticated water management technologies that are climate-dependent to irrigate the land, transforming the future of agriculture. With the use of specialist equipment like sensors, IoT in agriculture may autonomously water a field without the need for human involvement. Freshwater resource management is one example of a limited natural resource that requires integration of wireless sensor networks and mobile apps. Through precision agriculture, IoT in agriculture enables the best use of resources to provide high crop yields and lower operating costs. (Sayali Wadekar, Et al, 2016). Good water management in agrotechnology also gives benefits to the plants such as healthier root system. A plant's root system is severely impacted by oxygen shortage, which can result in root infections. A high oxygen content in the root zone creates ideal circumstances for root development, which improves plant health in general. (S Naeem, F Naeem et al, 2021). Strongly oxidising in nature, oxygen rids water of undesirable substances like heavy metals while promoting the growth of probiotic microbes that are good for you. Additionally, water with oxygen nanobubbles encourages the decrease of biofilm. (Lijuan Zhao, Li Lu et al, 2020)

Agriculture 4.0 is revolutionising farming lives owing to the development and acceptance of previously utilised in other productive sectors technology such as artificial intelligence, the Internet of Things, and robots. Due to the necessity to fulfil cleanliness and manipulation criteria in unstructured settings and in operation with fragile items, soft robotics and soft grippers in particular are potential ways to lead to innovative solutions in this industry. The goal of this review is to take a closer look at soft end-effectors for agricultural applications, with a focus on robotic harvesting. (Blanco-Canqui, H., & Lal, R. (2007). To that aim, the current status of automatic picking chores for a variety of crops is examined, with the goal of determining which tasks lack automated solutions and which approaches are most widely utilised based on the botanical features of the fruits. The most recent developments in the design and implementation of soft grippers are also given and addressed, with an emphasis on material qualities, manufacturing processes, gripping technologies, and proposed control approaches. (Basnet, C. B., Foulds, L. R., & Wilson, J. M. (2006).

1.4 Crop Harvesting Improvement

Over the years people are still using the traditional way in harvesting their crops that used so many times and many people to get it done fast. Machines and aggregates that execute a single operation are frequently employed in soil preparation for planting crops; their many runs across the surface of the field being treated raise energy costs, cause soil compaction, and lead to the formation and development of erosion processes. In light of this, it is necessary to develop cultivation methods, machinery, and units for soil preparation and crop planting. (Apazhev, A. K., et al. 2019.) Engineers are researching automation as a technique to cut costs and improve quality in greenhouses dedicated to fruit and vegetable production (see 'Ripe for the picking'). Robotic pickers and devices to monitor vegetable development are now being tested. Sensing technology ('Animal trackers') can assist livestock producers in managing the health and wellbeing of their animals. In addition, work is undertaken to enhance soil quality monitoring and management ('Silicon Saviorsours) and disease without resorting to indiscriminate agricultural usage ('Eliminating foes'). (King, Anthony. 2017)

Precision agriculture can streamline cantering and processing. It enables management to make rapid choices. Fertilizer applicator for tree crops that is fully automated. The system is made up of an input module that collects real-time sensor data, a decision module that calculates the best fertilizer, and NDA tribution pattern fertilizer output that controls the fertilizer application rate. (Banu, S. 2015) The usage of sensors and associated networks has yielded several benefits. Choosing sensors and putting them to good use to address difficulties in the agricultural area (Abbasi, Abu Zafar, Noman Islam, and Zubair Ahmed Shaikh. (2014)) Greenhouse technology in agriculture is moving in the direction of automation and information technology, because of the fast development and widespread application IOT (internet of things) technology. Based on the current state of agricultural production, the article investigates the integration of control and information networks using IoT technologies. It is proposed to use a remote monitoring system that combines internet and wireless communications. At the same time, an information management system is built, taking into consideration the system. The collected data by the system provided for agricultural research facilities. (Zhao, Ji-chun, et al. 2018)

1.5 Problem Statement

The researcher saw many farmers in Malaysia, especially in Sabah took a long time to harvest and their crop production is in slow progress due to many problems and limitations. Therefore, the researcher saw that farmers in Sabah mostly did not have the knowledge about agrotechnology or agricultural technologies that make farmer's yield or crop production slow. Researchers also saw that farmers in Malaysia are not familiar with farming technologies today, making their knowledge about farming limited to the traditional way or conventional way. Finally, the researcher acknowledges that farmer's do not know the benefits of implementing technology in farming.

1.6 Research Questions

1. Is there a significant relationship between benefits of agrotechnology implementation and crop harvesting improvement?
2. Is there a correlation between benefits of agrotechnology implementation and variables?
3. What is the most dominant among the existing variable for the crops harvesting improvement?

1.7 Research Objectives

1. To analyse the significant relationship between benefits of agrotechnology implementation and crop harvesting improvement
2. To examine the correlation between benefits of agrotechnology implementation and variables.
3. To verify what is the most dominant among the existing variable for the crops harvesting improvement.

1.8 Significant of Study

The aim of this study is to investigate the effective agrotechnology implementation toward crop harvesting improvement in Sabah. Therefore, this study expected to introduce about the benefits of agrotechnology implementation to people in Sabah that focused in Kudat district. Researcher also expect that people will more interested to start their farming activities and could focus to commercialize their crop after harvested.

1.9 Scope of Study

The researcher's scope of the study is among farmers and people to know about their opinion about agrotechnology to be implemented in farming activities. Due to the researcher's transport difficulty and limitation to reach people the researcher will use the google form to gain respondents along with this research. The google form will be distributed using social media such as WhatsApp and Facebook as the researcher's main platform to reach people.

CHAPTER 2

Literature Review

2.1 Introduction

This chapter will be focused on the study's independent variables and dependent variables. The data for both variables are taken from literature reviews, books that are related such as relevant articles also included especially related agrotechnology. After doing some studies on theories and models there are only several arguments from the articles were selected. Therefore, researcher used quantitative methods and utilized the same method to decide on research questionaries for survey purposes. Finally, all inputs will be transformed into a theoretical framework which here will relate to chapter 3. The ideas presented should indeed be founded on references and variable connections.

2.2 Effective Agrotechnology Implementation

The latest advances in Smart Farming, which already proven that the best system is implemented for everyone because of the benefits that users will get and the return on investment that they will obtain. Agrotechnology or smart farming that uses the latest techno, for example, drones, timer, and camera for inspection purposes. which make use of IoT, are slowly but steadily changing the face of traditional agriculture only by making them more effective for farmers, but also by decreasing crop waste. The goal is to develop a solution that

can send out notifications to farmers via various channels. Farmers will benefit from the device since it will provide them with real-time data (temperature, humidity, soil moisture, UV index, and IR) from their field, allowing them to take the required actions to increase crop yields while minimizing waste (water, fertilizers) (Doshi, Jash, Tirthkumar Patel, and Santosh kumKumararti 2019). Smart farming also gives a shorter time to harvest than the conventional method "Even though I'm still experimenting with this (smart farming) system, I'm proud to say that it has helped me to save time and manpower costs and has given me better yields too," he added. (New Sarawak Tribune, 2020) this is because the fertilizers that they use are automatically managed and suitable for the age of the plants needed. This study has 3 independent variables for the benefits of agrotechnology which are easy labor, IoT, and good management.

2.2.1 Make Job Easier

Labor means the number of work, physical, and social efforts required to create commodities and services in a given economy is referred to as labor. It provides the knowledge, labor, and customer service required to transform raw resources into completed goods and services (Kimberly Amadeo, 2021). Agrotechnology is an agriculture method that easy labor means having less work and the work that can be done by a small number of people and gives a big amount of return. Easy labor is important because much work can be done by the farmer and does not need to have many workforces to accomplish the work. Therefore, easy labor has three variables which are easy watering, quick analysis, and healthier yields.

2.2.1.1 Improved Watering System

Agrotechnology allows the farmer to provide water to plants automatically. With automatic watering irrigation systems, the farmer can do timely irrigation which means the plants can be watered when needed at the time and duration that has been set up. Automatic watering has accurate cut-off water compared to manual checking. (AgricultureVictoria, 2022). Therefore, it is important to improved watering system simplifies farming activities.

2.2.1.2 Continuous Feedback

The advances in information and communication technologies (ICT) and their application in agriculture have discovered the way for the emergence of Digital Agriculture, which has developed new methods for attempting to make agriculture more effective, quick, and easy to control while also being environmentally friendly. (M.-Tahar Kechadi, Michael Mcdonnell, 2020). Agrotechnology, gaining information on soil fertility, temperature, water contains, fertilizers, etc. all of these data are gathered using high positioning systems, smart sensors, and a range of computer applications combined with high-tech engineering. This will give farmers advantages in making better decisions. Hence, continuous feedback about crops condition provides relevant information for better operations.

2.2.1.3 Machineries Utilization

A machinery is a mechanical system that uses power to add forces and regulate movement to complete a task. Machinery today also involves artificial intelligence (AI) to make it easier to control even at a greater distance as long as there is an internet connection. Examples of technology and machinery in farming are automation harvesting, autonomous tractors, seeding machines, weeding machines, and drones. The benefits that farmers can get through the implementation of these technologies and machines are neat and fast and less working labor cost. Examples of works that can be done using machines and technologies are fruit picking, pesticides, and planting. Therefore, machineries (Equipment) utilization increases jobs speed.

2.2.2 Internet of Things (IoT)

The Internet of Things (IoT), often known as the Internet of Anything or the Industrial Internet, is a new technological paradigm that envisions a worldwide network of interconnected equipment and gadgets. The Internet of things is widely considered one of the most essential areas of future technology, and it is attracting significant interest from a variety of businesses. (Lee, I., & Lee, K. (2015). Examples of IoT in farming are agricultural drones, livestock tracking, smart greenhouses, and predictive analytics for smart farming. (IoT solutions world congress, 2022) Sensors, control systems, robots, autonomous vehicles, automated hardware, variable rate technologies, motion detectors, button cameras, and wearable gadgets are all

important components of this approach to farm management. This information may be utilized to monitor the overall health of the company, as well as employee performance and equipment efficiency. Being able to predict manufacturing output provides for improved product distribution planning. (Dagar, Rahul, Subhranil Som, and Sunil Kumar Khatri, 2018).

2.2.2.1 Good Farming Practices

The most important factor affecting agricultural productivity is the weather. It has the potential to affect crop growth, overall yield, insect incidence, water and fertilizer requirements, and other agricultural activities during the growing season. In other words, open-air farming is highly dependent on the weather and prone to its whims, especially currently, when climate change causes unpredictable weather that is beyond human control.

The greatest approach to safeguard crops and ensure a high and healthy yield is to be aware of real-time meteorological variables such as air and dew temperature, precipitation, and humidity. Drought, flood, hail, or frost can all create immediate plant stress, resulting in poor output and higher costs. (Agrivi, 2022) Weather stations incorporate a variety of smart agricultural sensors. They capture data from the environment and transfer it to the cloud from locations all over the field. The information supplied may be used to map climatic conditions, choose appropriate crops, and take the necessary steps to increase their capability. (Bauer, Jan, and Nils Aschenbruck, 2018). Therefore, Automation implementation will enhance good farming practice.

2.2.2.2 Effective Monitoring System

Greenhouse automation allows you to create an environment for your crops that is responsive to outside factors that would otherwise compromise their output. They may acquire accurate real-time information on greenhouse parameters including, temperature, soil condition, and humidity by using IoT sensors. Weather stations can automatically modify the circumstances to fit the supplied criteria in addition to gathering environmental data. A similar technique is used in greenhouse automation systems. (Navarro, Emerson, Nuno Costa, and António Pereira, 2020). Greenhouse automation systems will also allow reducing labor quantity of manual labor reduce labor expenses and allows workers to focus on more important tasks. If farmers want to develop their business or teach employees new skills, this is the

program for them. (Farooq, Muhammad Shoaib, et al, 2019). Therefore, Crops harvesting process will require effective monitoring system.

2.2.2.3 Up to Date Faming Method

Precision farming, often known as smart farming, is all about efficiency and making correct data-driven decisions. It's also one of the most common and successful IoT applications in agriculture. Farmers may collect a wide range of metrics on every aspect of the field microclimate and ecosystem with IoT sensors, including illumination, temperature, soil condition, humidity, CO2 levels, and insect infestations. Farmers may use this information to predict the quantity of water, fertilizer, and pesticides their crops require, cut costs, and grow better, healthier crops. Precision farming can lead to good crop management this is because we can successfully avoid illnesses or pests that might impair your production, and keep an eye on your crop's progress and any irregularities. (Dagar, Rahul, Subhranil Som, and Sunil Kumar Khatri, 2018). Hence, up to date (Modern) farming method produces high harvesting rate.

2.2.3 Management Efficiency

Good management in farming will ensure the farmer will get the maximum quantity, and quality of their yields. The conventional method of farming has low yield production and many of the crops have infections that are caused by the pest. They cannot manage to control the pest due to poor management this causes much effort and labor to make sure their crops are in good condition when the crops are harvested. Hence, good management also ensures the farmer manages the health of the plants by managing the pesticides, water, and fertilizers given.

2.2.3.1 Good yield productivity

Spraying too much or too little impacts the crop's quality, resulting in uneven regions of scorched plants and stunted, underperforming plants. Farmers may cultivate dependably equal and healthy crops by employing Section Control to eliminate over and underlaps, maximizing yields. (Virk, Ahmad Latif, et al, 2020). Farmers may use the technology to assist them to decide when to grow and harvest crops. As a consequence, precision farming may help

farmers manage their time better, save money on water and chemicals, and grow better crops with higher yields. (Bhange, Manisha, and H. A. Hingoliwala, 2015). Therefore, Good yield (Productivity) will be increased with systematic farming.

2.2.3.2 Better Quality

Crops quality is when the crops do not have any defects or infections by pests. The crop's quality will be better because of the good management n pesticides, water supply, and fertilizers given to the plants. Therefore, with good care, the crops will last longer than the others. (Phasinam, Khongdet, Thanwamas Kassanuk, and Mohammad Shabaz, 2022). Hence, Better quality of crops is always achievable with the appropriate operations.

2.2.3.3 Adequate Supply of Water

When rainwater is insufficient for plant development, irrigation systems must be used to provide water to the plants. There are several techniques for providing irrigation water to plants, each with its own set of benefits and drawbacks. (Othmani, N. I., N. M. Sahak, and M. Y. M. Yunos, 2021) A sufficient water supply has a good production and pumps capability to give the required amount and quality. Flow fills the stem of a plant and goes up to the leaves. When a plant is sufficiently hydrated, the water pressure inside the stems and leaves is sufficient to keep the leaves robust and sturdy; when a plant is not adequately hydrated, the tension inside the stems and leaves diminishes, causing the leaves to wilt. Photosynthesis requires water as well. (Irmayani, et al, 2018). Therefore, It is always important to ensure adequate supply of water.

2.3 Crops Harvesting Improvement

Everyone wants to get harvesting to be done quicker and easier. The conventional method of harvesting is good but it needs a longer time to harvest and much labor needed if they want to harvest faster and it is also much tiring. Technology implementation in crop harvesting will help farmers to get the harvesting job done much faster this is because using machines and technologies can do much work at the same time, therefore, it requires much less work to get the job done and it is also less time needed. (Wood, A. W. 1991).

2.3.1 Better Output

Every day more demand from the consumer will rise therefore by implementing agrotechnology farmers can make produce more yields. More yields will give farmers a big amount of harvesting. With the big amount of harvesting, it can provide customers demand and can also provide to another place. According to *Info Pertanian* magazine with technology implementations, the amounts of yields that can be harvested by farmers will be multiplied by 1 or 2 times more than the conventional method. Hence, technology implementation in farming will ensure better output.

2.3.2 Simplify activities

Agrotechnology is a technology for agriculture activity purposes and it has a lot of benefits to help farmers to get their job done in a faster and more efficient way. Before the technology for harvesting was invented farmers would take a long time to do harvesting because they only use human strength and no machine involvement. Everyone wants to get the job done quickly therefore to make it quick the technology machinery needs to be implemented. Short-time harvesting would save the farmer's time to get another job to be done. (Wood, A. W. (1991). Therefore, Improved facilities help simplify activities (Process) for harvesting.

2.3.3 Continuous Supply

Through agrotechnology involvement, it can give many benefits to consumers therefore if they receive many benefits, they will be happy to buy more the next time. Consumers will be satisfied because of the quality and they will repeat their order or would like to buy again. With good care and management, the farmer will get a good result for their yields and crops harvested which are much better than the conventional method. Therefore, it is important to satisfy consumers needs with continuous supply of crop products.

2.3.4 Shorter Time

Technology implementations can take less time for plants to produce yields and to be ready to harvest. This is because the agrotechnology can give fertilizers to plants according to schedule, the water given to the plants is also adequate, and the pest control management is also good. Making the plants produce faster is all depending on the fertilizers given because fertilizers are used to boost the plant's growth and processes. Therefore, by implementing agrotechnology the time taken is much shorter. While the conventional method is slower this is because the conventional method is more relying on the weather. (Bouma, J. A., Hegde, S. S., & Lasage, R. (2016). Hence, shorter time taken for harvesting season will improve the agrotechnology business.

2.3.5 Increases Shelved life

When crops are of excellent quality it will result in a longer and more durable crops freshness after harvest this is due to good pest control. Good pest control will ensure the crops do not have any defects or infections because a few infections from the pests will make the crops rot faster. Therefore, farmers must ensure their plants are in good condition so that they can ensure good crop quality and longer freshness. Farmers can take good care of the quality of the crop by having many accessibilities by implementing agrotechnology. Therefore, effective farming technique increases shelved life.

2.4 Theoretical Framework

After reading and doing research on relevant articles, journals, and books about the benefits of agrotechnology implementations the researcher comes out with this framework.

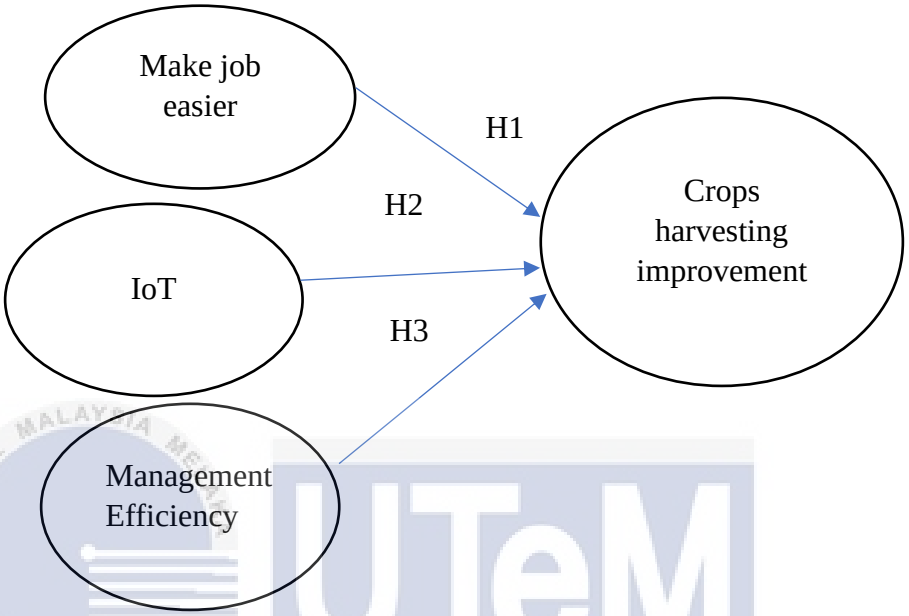

Figure 1: Research Framework

2.5 Research Hypothesis

H1: There is a significant relationship between make job easier and crops harvesting improvement.

H2: There is significant relationship between IoT and crops harvesting improvement.

H3: There is a significant relationship between management efficiency and crops harvesting improvement.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

This chapter described the data collection methods utilized by the researcher in this study, such as the techniques, steps, and samples. This study also aims to get a better knowledge of the research methods utilized to collect data on the advantages of agrotechnology deployments in crop harvesting for Sabah residents. The term method refers to a technique for gathering and analysing data, and the sample data can be collected using quantitative or qualitative techniques. Aside from that, the researcher believes that having a fundamental grasp of research techniques is necessary so that the researcher may apply them to the research.

3.2 Research Design

A research design is a method or concept for carrying out the various duties of a research project. The researcher must understand the study design to complete the assignment properly. (Akhtar, Dr. Md Inaam, 2016). The goal of research design is to allow the researcher to stay on track and avoid deviating from the tasks at hand. It is a precise strategy for the research process as a whole. Experiment design is a critical part of every research project. In terms of time, people, and money, a bad study design might send the entire research work to a halt. The importance of doing research design is, that forming a research design aids the

researcher in making the best judgments possible at each stage of the investigation, it aids in the identification of the study's key and minor objectives, by giving minute information at each phase of the research process, it makes the research study successful and entertaining, the researcher may simply frame the study work's aims via the design of experiments (research design). (Abbott, Martin Lee, and Jennifer McKinney, 2013).

A good research design aids the researcher in completing the study's objectives promptly and in obtaining the best answer to the research difficulties. It enables the researcher to complete all tasks more efficiently, even with limited resources. The fundamental benefit of a strong study design is that it ensures that the research is accurate, reliable, consistent, and legitimate. The problem statement of the research endeavour is framed by the researcher at the start of the investigation. (Salkind, Neil J., ed, 2010) The researcher must next determine the sampling points, number of samples, sample size, and placement of the samples. The following stage is to determine the study's operational variables or parameters, as well as how they will be measured. The results are collected, interpreted, and disseminated in the last phase. (Bickman, Leonard, Debra J. Rog, and Terry E. Hedrick, 2009)

The researcher's initial consideration in the design of this study should be the aims and strategy. The researcher must have a solid understanding of the research questions before beginning to plan research. The researcher's goals and priorities should inform study design decisions, and the researcher must consider what they wish to achieve. The first choice a researcher should make is whether to conduct research using a qualitative data collection approach. If the research includes humans, it's equally important to consider practicalities and ethics. The research questions ethics should be considered by the researcher: Is it conceivable for researchers to gather the essential data, such as researching in a certain place, in the time it takes to collect data and publish a research paper?

The second stage is to decide whether you want to conduct a quantitative or qualitative study. Experimental and quasi-experimental procedures are two types of quantitative methods that may be used to investigate problem relationships. Descriptive and correlational designs, on the other hand, are both quantitative designs that may quantify variables and define their relationships. (Bickan, Leonard, Debr J. Rog, and Terry E. Hedrick, 2009) Aside from it as well, there are phenomenological, ethnographic, grounded theory, and case study varieties of qualitative design. Phenomenological studies are descriptive examinations of human consciousness. Through a conversation, respondents will be asked to characterize the event

thus according to their opinions. (Hedrick, Terry Elizabeth, Leonard Bickman, and Debra J. Rog, 1993) The next step is ethnographic research, which involves gathering and evaluating data on cultural groups, and grounded theory, which involves building a method of inductive reasoning by carefully examining or analyzing qualitative data. A case study, on the other hand, is thorough research into a single subject, such as a place, an organization, or an event, using data gathered from a variety of sources or approaches. (Hedrick, Terry Elizabeth, Leonard Bickman, and Debra J. Rog. 1993).

Next, the researcher's population and sample technique are identified in the third phase. The research design should specify who or what the researcher is examining, as well as how participants or subjects will be chosen. In research, the population might be whatever the researcher wishes to look into, although it generally refers to a group of people. (Myers, Jerome L., Arnold D. Well, and Robert F. Lorch Jr, 2013.)

Furthermore, is to select a data-gathering method that is appropriate for your needs. The researcher picked the survey study design for this study because it helps to answer the report's research aim and objectives. The questionnaire survey looks at a population sample to come up with a quantitative representation of views, patterns, or views. Based on the sample data, the researcher also makes generalizations about the population. In addition to survey studies, researchers might employ secondary data to supplement their findings. (De Vaus, David, 2001).

The next phase entails devising a data-gathering strategy. To obtain consistent and reliable data, the researcher must carefully arrange the methodologies used. This is especially important in the survey method since the researcher must precisely identify the variables and ensure that the observations are valid and effective.

The last stage is to figure out how the researcher will analyze the data. The researcher will employ some type of statistical analysis in quantitative data analysis since it allows them to summarise the sample data, test hypotheses, and create estimations. Aside from that, a quantitative approach may be used for descriptive research since a descriptive survey allows researchers to provide an overall overview of study factors. (Marczyk, G. R., DeMatteo, D., & Festinger, D. 2010).

3.2.1 Descriptive Design

Descriptive research is a sort of research approach that is used to describe an actual occurrence, identify, and gather information on the features of a certain topic, such as a community, group, or individual. (Doyle, L., McCabe, C., Keogh, B., Brady, A., & McCann, M. (2020). Descriptive research is another sort of study that focuses on characterizing the characteristics of the variables under study. Instead of focusing on the "why," this technique focuses on answering questions about the "what" of the research issue. (Lambert, V. A., & Lambert, C. E. (2012) Rather than concentrating on the "why," descriptive research simply describes the features of the statistics being studied. A survey is a quantitative research approach that researchers utilize. Respondents responded to surveys, polls, or questionnaires in survey research, and the surveys can be utilized online or in-person Furthermore, the descriptive study might point up areas where improvement research is needed as well as connections between variables that need to be investigated further. (Magilvy, J. K., & Thomas, E, 2009).

3.3 Methodological design

The most essential operational decisions done by researchers are based on qualitative methods. Quantitative data is presented as a list of elements, but qualitative data is given in words and visuals. The quantitative technique was chosen by the researchers in this investigation. The quantitative approach entails collecting numerical information from several different sources. Quantitative data, on the other hand, is based on a huge number of people and is therefore potentially easier to get and evaluate.

3.4 Data Collection

Data collection is the act of acquiring and quantifying analysing measures of the variables in a systematic manner that allows researchers to answer study questions, test hypotheses, and percent of overall. (Sapsford, R., & Jupp, V. (Eds.), 1996).

3.4.1 Primary Data

Primary data is one of the two primary categories of data; secondary data is the other. These two data types have essential research applications, but we'll focus on the major data type in this essay. (Hox, J. J., & Boeije, H. R. (2005). Information is gathered directly from primary sources by researchers using methods such as interviews, questionnaires, and experiments. Primary data is generally acquired directly from the source—the place where the data came from—and is considered the greatest type of data in research. (El-Shimi, A., Kalach, R., Kumar, A., Ottean, A., Li, J., & Sengupta, S. (2012). Sources are often chosen and adjusted to fulfil the objectives or requirements of a certain research project. Before deciding on a data collecting source, it's also necessary to figure out what the research's goal is and who the target audience is. (Dyer, C. B., Ashton, C. M., & Teasdale, T. A. (1995).

3.4.2 Secondary Data

Apart from contacting the main source, data can also be gathered through a third party, which is a frequent secondary data technique. It makes use of information gathered from prior studies in order to conduct new research. (Johnston, M. P. 2017).

Secondary data is one of the two main categories of data, with primary data being the other. These two sorts of data are quite valuable in research and statistics, but for the sake of this post, we'll stick to secondary data. Secondary data is information that has previously been gathered from primary sources and made accessible to researchers for use in their own studies. It's a sort of information that has previously been gathered. A researcher may have collected data for a specific study and then made it available for other researchers to utilise. As in the case of the national census, the data may have been collected for general use rather than for specialised research purposes. Information that is classed as secondary in one study may be considered main in another. This is the scenario where data is reused, making it the main data for the early research and secondary data for the subsequent research. (Boslaugh, S. 2007).

3.5 Location Research

This study aims to know what is the Effective Agrotechnology Implementation Toward Crop Harvesting Implementation in Sabah. This is because the researcher believe that many people in Sabah do implement agrotechnology or have the knowledge about agrotechnology.

3.6 Time Horizon

In futures studies, time horizons generally relate to study periods or a chronological horizon of different breadth. According to Kosow and Gaßner (2008), there are three fundamental temporal horizons: short-term (up to ten years), medium-term (up to 25 years), and long-term (beyond 25 years).

As an alternative temporal horizon, Kosow and Gaßner (2008) separate static observations from a point in time in the future, which is frequently connected with normative tactics. This type of retrospective is commonly utilised when creating "static" or "end-state" situations.

3.7 Sampling Design

A sample design is a method for selecting a representative sample from a population. It refers to the method or approach used by the researcher to pick things for the sample. This can relate to the study's method or technique for selecting things for the collection. To get a meaningful conclusion, the researcher must carefully consider how he or she picks a sample that is representative of the entire group. (Olea, R. A., 1984).

When conducting research on a group of people, it's uncommon that you'll be able to collect data from every single one of them. Rather, you choose a sample. The sample is the number of people who will actually take part in the study. We must carefully consider how you will pick a sample that is representative of the entire group in order to make accurate inferences from your findings. There are two different types of sampling techniques. Random selection is used in probability sampling, which allows you to draw strong statistical judgments about the entire group. Non-probability sampling entails making non-random selections based on convenience or other factors to make data collection easier. (Olea, R. A., 1984)

3.7.1 Sampling Technique

When doing research on a group of people, the researcher should first choose a sample. A sample refers to a group of people who took part in the study. The sampling process is broken down into five phases by researchers. The initial step will be for the researcher to identify the target population. The term "target population" refers to a group of people or things. The researcher selects a sampling frame in the second step. All of the components in the population from which the sample will be obtained, or a collection of units that can be sampled, are included in sampling frame lists. The researcher chose people from Kudat, Sabah as a sample to conduct the study.

The next step is to describe the sampling strategy. This sampling can be carried out using a variety of probabilistic (random selection) or non-probabilistic (non-random) procedures. If the sampling frame is roughly the same as the target population specified by the researcher, random sample can be used to select a sample; however, if the sample design does not represent the target group, the researcher can choose a non-random choice that can provide at least a picture of the people in the surrounding area. To pick samples at random, the researchers in this study utilised a basic random sampling approach. In a basic random example, each member of the population has an equal chance of being picked. Researchers can also undertake this sort of sampling using random number generators or other totally chance-based methods.

The final step is to figure out how big your sample will be. The number of units in a sample is referred to as sample size. The researcher will consider a variety of issues while determining the size of this sample, including time, cost, and even the facilities used. A bigger sample size is beneficial in general, but it necessitates a significant investment of time and money. The researcher used a total of 100 people in this study to collect data.

3.7.2 Sampling Plan

An example plan defines when and how measurements will be taken, as well as what material will be used and how they will be taken. Sampling strategies should be developed such that the obtained data includes a fair representation of the parameters of the model and answers to all of the goals' questions. The collection in this research is set by computations, tables, and explanations for each data gathered, according to the researcher.

3.8 Pilot Test

Pilot testing allows you to evaluate your research technique with a small group of test subjects before conducting your main study (Workplace, 2018). Despite the fact that this is an extra step, it may be the best time spent on any research endeavor. Pilot testing aids in determining the viability of your research project. It can help you figure out how to effectively deploy numerous resources within your scientific inquiry. Pilot experiment data might assist you in defining your main research issue. Pilot testing can be used to create a baseline survey. (Winderfunnerl, 2022).

3.9 Questionnaire Design

A questionnaire is a research instrument that consists of a series of questions that are used to gather data from respondents. These instruments use an interview-style structure and incorporate either written or spoken questions. Questionnaires can be qualitative or quantitative, and they can be delivered online, over the phone, on paper, or in person. They also don't have to be administered with a researcher present.

Questionnaires are popular research methodologies because they provide a quick, efficient, and low-cost way to collect huge quantities of data from big sample sizes. These methods are very useful for determining a subject's preferences, intents, attitudes, and views. Researchers can acquire both qualitative and quantitative data by using open and closed research questions, resulting in more thorough results.

Thus, the questionnaire is tailored to the sort of data the researcher seeks. Aside from that, effective survey questions and a balanced mix of open-ended and closed-ended questions should be used in research to obtain relevant data. In this study, data will be collected by a survey, which will be distributed to the author through Google Form by the researcher. The researcher used the Likert scale, The scales were measured using both the nominal and ordinal scales. Except for the participant's personal information, which was graded on nominal data, the majority of the surveys are categorized on an ordinal level. The nominal scale is a naming scale in which a variable is simply named or labeled without regard to its order, whereas the ordinal scale is a measuring scale in which the order of the variables is described. The researcher utilized the Likert scaling method to analyze the questionnaire questions in this study. The Likert scale is shown below.

Table 1: Likert Scale

Strongly Agree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

(Sourced from Mark Bounthavong, 2019)

3.10 Data Analysis

Data analysis is by far the most critical element of any study. Researchers can use data analysis to assist them to synthesize the information gathered through questionnaire surveys. It also entails analyzing and evaluating data to find patterns, connections, and trends utilizing analytical or person understands. Data analysis is the process of cleaning, manipulating, and modeling data to extract information that may be used to make research decisions. This data analysis also tries to extract important information, which will be used by academics to make judgments. (Brandt, S., & Brandt, S. (1998).

Researchers utilize several methods to examine data. The first step is to locate the data. The researcher will determine what type of research to do in this initial step. The researchers will gather the data required to facilitate the study in the second step. The researcher can identify the data that will be used and how that information will be used at this stage. Quantitative questionnaires or secondary data can be used to obtain data. Third, once the researcher has acquired the necessary data, the researcher should clean it up and prepare it for analysis since not all of the data obtained will be used in this study because part of it is unsuitable for the study. (Kenny, D., Kashy, D., & Bolger, N. (1998). The data must next be analyzed and interpreted. Various approaches, including regression, statistical analysis, and reliability, are used to evaluate and alter the data at this stage to help the researcher conclude. To examine the data in this study, the researcher used descriptive analysis, reliability of the constructs, Reliability Test, and linear regression analysis. (Freeland, S. L., & Handy, B. N. (1998).

3.10.1 Descriptive Analysis

Statistical analysis is another name for descriptive analysis. One sort of data analysis is statistical analysis. Using previous data in the form of a dashboard, quantitative analysis. Statistical analysis involves the gathering, analysis, interpretation, presentation, and modeling of data, and it will analyze a data set or sample of data. Descriptive analyses, summarise and arrange the properties of a data collection. This data set may consist of replies or observations from a group of subjects. (Lawless, H. T., & Heymann, H. (2010). There are three types of descriptive statistics: dispersal, which is focused on the frequency of each value; frequency, which is worried about the regularity of each value; and frequency, which is interested in the recurrence of each value. The average price, such as mode, median, and mean, is what the descriptive statistic is concerned with. Whereas the way numbers are dispersed is studied, variability or distribution is investigated. The range, standard deviation, and variance, on the other hand, all reflect unique propagation properties. At the same time, the measure of variability provides the researcher with insight into how the response's value is communicated. The researcher chooses numerous demographic parameters such as age, gender, and course. Percentages are often used by the researcher to characterize and obtained through the survey technique. (Berthold, M., & Hand, D. J. (2003).

3.10.2 Reliability Analysis

The qualities of measuring scales and the items that make up the scales may be studied using reliability analysis. The Reliability Analysis technique produces a variety of regularly used scale reliability metrics as well as information on the correlations between specific items measured. (Huang, X., Li, Y., Zhang, Y., & Zhang, X. (2018).

The researcher can consider the nature of the weighing scale and the pieces that make it up using reliability analysis. The Reliability Analysis approach produces a range of commonly used scale reliability measures as well as data on scale item connections. Aside from that, a study might make use of trustworthiness. To discover how strongly the survey questions are connected to one another, conduct an analysis. In addition, the researcher can obtain an initial overview of the scale's consistency or internal consistency. Consistency is important, as is identifying problematic components that should be eliminated. Consider the case when a specific scale constantly weights boxes at 10 pounds more than their real weight. This scale is

dependable since its measures are stable, but it is not legitimate when it does not estimate the real weight. (Zhang, L., Lu, Z., & Wang, P. (2015).

Table 2: Cronbach's Alpha Interpretation

Cronbach Alpha	Internal Consistency
$\alpha \geq 0.9$	Excellent
$0.9 > \alpha \geq 0.8$	Good
$0.8 > \alpha \geq 0.7$	Acceptable
$0.7 > \alpha \geq 0.6$	Questionable
$0.6 > \alpha \geq 0.5$	Poor
$0.5 > \alpha$	Unacceptable

(Source from Deng, Lifang and Wai Chan, 2017)

3.10.3 Pearson Correlation Analysis

The test statistic Pearson's correlation coefficient assesses the statistical link, or association, between two continuous variables. Because it is based on the concept of covariance, it is recognised as the best approach for quantifying the relationship between variables of interest. (Jim frost, 2022)

Table 3: Correlation Interpretation

Coefficient Interval	Correlation
0.00 – 0.199	**Very Weak**
0.20 – 0.399	**Weak**
0.40 – 0.599	**Medium**
0.60 – 0.799	**Strong**
0.80 – 1.000	**Very Strong**

(Darmawan Napitulu, Leon Abdilah, Robbi Rahim and Dahlan Abdullah, 2018)

The intensity of a link between two data is measured by correlation coefficients. A correlation between variables means that as one variable's value changes, the other tends to change in the same way. We may use the value of one variable to forecast the value of the other variable if we know the relationship. Height and weight, for example, are linked; as height rises, so does weight. As a result, if we witness someone who is abnormally tall, we can assume

that he is also extremely heavy. Correlation coefficients are a quantitative measure of the direction and intensity of this propensity to fluctuate in tandem in statistics. There are several sorts of correlation coefficients that may be used with various types of data. The most prevalent form of correlation—correlation Pearson's coefficient—is discussed in this essay.

Scatterplots are a quick and easy technique to see if two sets of continuous data are related. For example, the current weight of or before girls are depicted in the scatterplot below. Each dot on the graph represents a different female and their age and weight combination. These are true data from an experiment that has been conducted. Table 3 below show the correlation interpretation to know whether the result show strong or weak correlation.

3.10.4 Linear Regression Analysis

Linear regression analysis is a powerful technique for predicting the value of one variable on the basis of another. The effect on the dependent variable you wish to forecast. The independent variable is the one you're using to forecast the value of the other variable. (Seber, G. A., & Lee, A. J. (2012). Linear regression analysis is a powerful technique for predicting the value of one variable on the basis of another. The effect on the dependent variable you wish to forecast. The independent variable is the one you're using to forecast the value of the other variable. (Montgomery, D. C., Peck, E. A., & Vining, G. G. 2021).

Multiple linear regression can predict the outcome of a test by estimating the connection between two or more independent variables and one dependent variable. (Uyank, Gulden Kaya, and Neşe Guler, 2013) combined multiple explanatory factors to create a response variable. In addition, this regression models a linear connection between the illumination (independent) and response variables (dependent). Multiple linear regression can be utilised when the researcher wishes to determine the degree of the association between two independent variables and one dependent variable. (Uyanık, G. K., & Güler, N. (2013). For example, the efficacy of graduate marketability depends on message content, job matching, and job specialty.

Rebecca Bevans (2020) also presents a formula for doing multiple regression.

$y = \beta 0 + \beta 1X1 + \ldots + \beta nXn + \varepsilon$

y = the predicted value of dependent variable

$\beta 0$ = y-intercept (the value of y when all other parameters are set to 0)

$\beta 1X1$ = regression coefficient ($\beta 1$) of the first independent variable ($X1$) or the effect that increase the value of the independent variable has on the predicted y value)

= do the same for however many independent variables researcher is testing

βnXn = regression coefficient of the last independent variable

e = model error or how much variation there is in our estimate of y.

3.11 Summary

In conclusion, research design and strategy are critical since they can ensure the success of this study. Quantitative data is also used in this study, with researchers choosing survey techniques and secondary data to collect data or resources for their studies. Furthermore, one of the distinctive characteristics of descriptive research is the ability to analyse both quantitative and qualitative research methodologies. As a result, while performing descriptive research, researchers might employ a range of strategies to improve the study process. Various approaches, such as descriptive, reliability, Pearson correlation, and linear regression, will be used to evaluate and interpret the data collected.

CHAPTER 4

RESULT AND DISCUSSION

4.1 Introduction

In chapter 4, the researcher analyzes the study. The questionnaire was distributed to 849 people and got 125 people responded. Researcher targeted the people in Sabah who has the experience in farming this is to know whether the people in Sabah are aware about the change in agriculture. Before the full data was collected the researcher did pilot test that were answered by 30 people. Both pilot test and full set of data took the researcher one month to get it done. The objective of this survey is to know whether independent variables and dependent variable are correlated. This questionnaire is divided into a few parts which are section A demographic, section B that contains independent variables and section C that contains dependent variables.

Additionally, the researcher examined the data from both the pilot study and the whole data set using the Statistical Software Package for Social Science (SPSS). A piece of software called IBM SPSS Statistics, often known as the "Statistical Package for the Social Sciences," is used for statistical analysis, data management, and data documentation. This brief chapter provides an introduction to the SPSS program and a rundown of its features. Data prepping, data import, parametric and nonparametric statistical test choices, exporting and altering statistical results, and creating charts and tables are addressed. (Zuzana Čaplová, Petra Švábová, 2020) With the use of this program, researchers may assess and quantify data, create

tables, examine difficult statistics, identify trends in distributions, and generate tabular reports. A popular program for statistical analysis in social science is SPSS. Additionally, data miners, survey businesses, the government, educational researchers, marketing groups, and market researchers use it. A popular program for statistical analysis in social science is SPSS. Additionally, data miners, survey businesses, the government, educational researchers, marketing groups, and market researchers use it.

4.2 Pilot study results

Pilot testing technique repeatedly used by researchers to get the reliability of questionnaires. Researchers can use pilot testing to access the questionnaire under survey settings and identify any issues. The researcher distributed the questionnaires to 30 people in pilot study and transfer it to SPSS for result. The researcher updated the questionnaire and do some paraphrasing to the questionnaire if needed. Table 1 shows that 30 respondents have valid data and all the data has been processed with zero missing data.

Table 4: Presents case processing summary

		N	%
Cases	Valid	30	100.0
	Excluded[a]	0	.0
	Total	30	100.0

(Source from SPSS output)

Table 5: Pilot Study Reliability Analysis

Variables	Cronbach's alpha	No of items
Make job easier	.705	3
IoT	.697	3
Management efficiency	.807	3
Crops Harvesting Improvement	.789	5

(Source from SPSS output)

For the dependability of pilot test findings, Table 2 shows Cronbach Alpha. In Table 2 page 26 it shows the Cronbach Alpha Interpretation that show excellent to unacceptable Cronbach's alpha value. In this pilot study, 14 questions were asked. Cronbach's Alpha value for the independent variable "making job easy" is 0.705 with 3 items, Internet of Things (IoT) is 0.697 with 3 items, and Management Efficiency is 0.807 with 3 things. Cronbach's alpha for 5 items is 0.789 for the dependent variables related to Crops Harvesting Improvement.

4.3 Respondents Profile Information

There were certain questions for demographic in section A. This section gave some basic information of the respondents who completed the questionnaire. There were total 125 respondents completed to answer the questionnaire and returned to the researcher. The target respondents were required to answer question such as gender, age, employment sector, Knowledge about agrotechnology, farming experience, interest to get involve in modern farming and interest in agrotechnology.

The table 6 shows that there were 70 (56%) female respondents while male respondents consist 55 (44%). The majority of the groups answered were around 20-35 of age with frequency of 63 people or 50.4%. follows by age 36-50 which consist 39 people or 31.2% the 19 and below group age were 12 people or 9.6% and finally 51 and above 11 people or 8.8%.

Table 6: Demographic profile of the sample.

	Items	Frequency	%
Gender	Female	70	56
	Male	55	44
	Total	**125**	**100.0**
Age	19 and below	12	9.6
	20-35	63	50.4
	36-50	39	31.2
	51 and above	11	8.8
	Total	**125**	**100.0**
Employment sector	Government	26	20.8
	Private Sector	22	17.6
	Self Employed	34	27.2
	Student	34	27.2
	Others	9	7.2
	Total	**125**	**100.0**

(Source from SPSS output)

4.4 Descriptive Analysis

4.4.1 Do you have knowledge about agrotechnology?

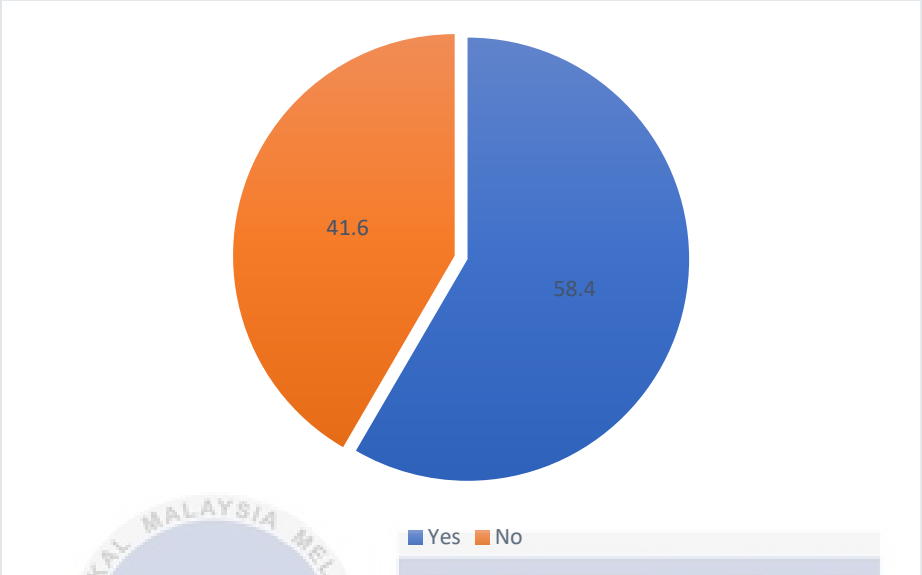

Figure 2: Do you have knowledge about agrotechnology?

Figure 4.1 shows a pie chart about question about do you have knowledge about agrotechnology? The majority respondent answered yes that they do have knowledge about agrotechnology which the frequency 73(58.4%) and no at 52(41.6%).

4.4.2 Do you have any farming experience?

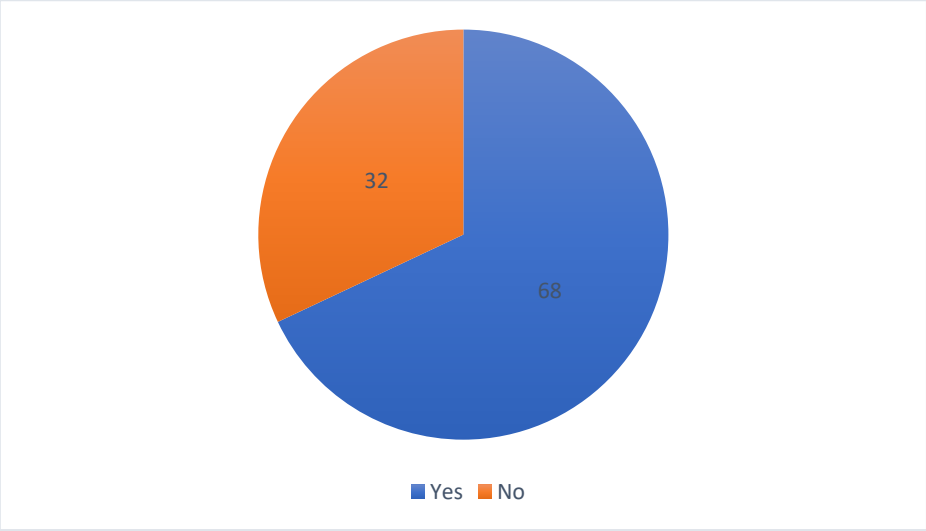

Figure 3: Do you have any farming experience?

The pie chart in 4.2 is about do you have any farming experience? Through the result in the pie chart it shows that majority people has the experience in farming which the frequency for yes is 85 (68%) and no 40 (32%).

4.4.3 Do you have interest to be an entrepreneur in modern farming?

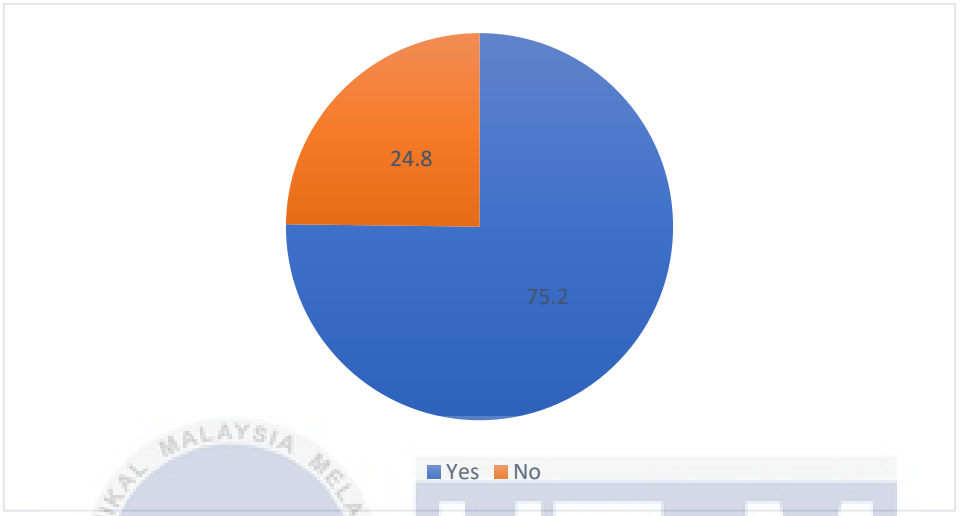

Figure 4: Do you have interest to be an entrepreneur in modern farming?

Figure 4.3 show pie chart about do you have interest to an entrepreneur in modern farming? The pie chart shows that an outstanding result of yes than no. Which the frequency for yes is 94 (75.2%) and no 31 (24.8%).

4.4.4 Are you interested to learn about agrotechnology?

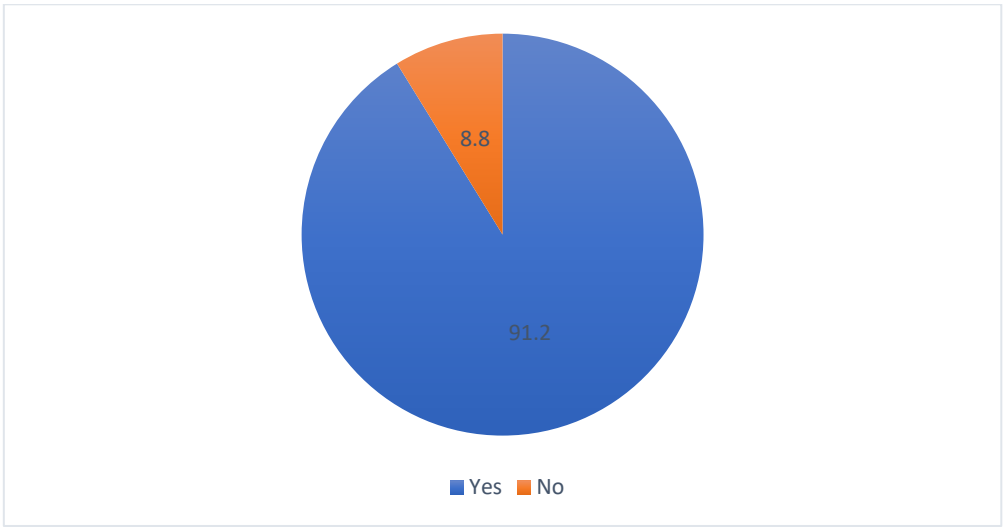

Figure 5: Are you interested to learn about agrotechnology?

The pie chart in figure 4.4 about are you interested to learn about agrotechnology? Shows that most of the respondent are interested to learn about agrotechnology which the frequency for yes is 114 (91.2%) and no 11(8.8%). This indicated that most of the respondents have the interest to learn and know about agrotechnology.

4.5 Results Analysis

4.5.1 Reliability Analysis

Table 7: Reliability Analysis

Variables	Cronbach's alpha	No of items
Make job easier	.700	3
IoT	.423	3
Management efficiency	.601	3
Crops Harvesting Improvement	.791	5

(Source from SPSS result)

Table 6 below shows that the reliability using 125 samples to see whether the questionnaires are valid or not valid. The Cronbach's alpha for make job easier that consist 3 items is .700 which is acceptable. Next is, IoT variable that consist 3 items the Cronbach Alpha is .423 which is unacceptable. While for management efficiency that consist 3 items is .601 questionable and finally for crops harvesting improvement that consist 5 items is .791 which is acceptable.

4.5.2 Correlation Analysis

Bivariate correlation analysis, commonly known as correlation analysis, focuses on establishing if a link between variables exists before figuring out its strength and course of action. To describe the relationship between two variables in a survey or time series, correlation analyses are frequently utilized. This post presents the idea of Pearson's correlation coefficient and gives a quick summary of the characteristics and restrictions of various commonly used correlation coefficients. Additionally, the main determinants of these correlation coefficients' interpretability are explored. (Andreas Philippe Hüsser, 2017).

Table 8: Correlation result

Correlations					
		Make Job Easier	IoT	Make Job Easier	Crops Harvesting Improvement
Make Job Easier	Pearson Correlation	1	.615**	.709**	.654**
	Sig. (2 -tailed)		.000	.000	.000
	N	125	125	125	125
IoT	Pearson Correlation	.615**	1	.658**	.610**
	Sig. (2 -tailed)	.000		.000	.000
	N	125	125	125	125
Management Efficiency	Pearson Correlation	.709**	.658**	1	.678**
	Sig. (2 -tailed)	.000	.000		.000
	N	125	125	125	125
Crops Harvesting Improvement	Pearson Correlation	.654**	.610**	.678**	1
	Sig. (2 -tailed)	.000	.000	.000	
	N	125	125	125	125
** Correlation is significant at the 0.01 level (2-Tailed)					

(Source from SPSS output)

Table 8 above shows the results of the study on the relationship between the effectiveness of agrotechnology and the crops harvesting improvement. Make job easier and IoT were significantly correlated, $r = .615$, $p < .05$ while make job easier and management efficiency were significantly correlated where $r = .709$, $p < .05$. For IoT and make job easier were significantly correlated where $r = .615$, $p < .05$ while for IoT and management efficiency were significantly correlate where $r = .658$, $p < .05$. For management efficiency and make job

easier were significantly correlated where r = .709, p < .05 while for management efficiency and IoT were significantly correlated where r = .678, p < .05.

4.5.3 Regression Analysis

In this chapter, multiple regression analysis is helpful for investigating the relationship between a single dependent variable and a number of independent variables. The results of the multiple regression analysis between all parameters and the characteristics of potential graduates are displayed in table 9.

4.5.3.1 R-Square

To determine if the efficient agrotechnology characteristics substantially predicted the improvement in crop harvesting, multiple regression was performed. The result indicated the three predictors explained 54.4% of the variance (R^2 = .544, P < .001). I was found that for make job easier is significantly predicted crops harvesting improvement (β = .259, p < .002), as did IoT **(**β = .212, p < .012). The management efficiency significantly predicted the crops harvesting improvement where (β = .001, p < .001)

Table 9: R-Square

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.737[a]	.544	.532	.45071
a. Predictors (Constant), MEANIV3, MEANIV2, MEANIV3				

(Source from SPSS output)

Table 10: Coefficient Result

Coefficients						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std Error	Beta		
1	(Constant)	.705	.034		2.316	.022
	Make Job Easier	.259	.083	.284	3.314	.002
	IoT	.212	.084	.215	2.536	.012
	Management Efficiency	.357	.101	.334	3.521	.001
a. Dependent Variable: Crops Harvesting Improvement						

(Source from SPSS output)

According to Table 10 t-value and significance value results, the value of educational materials, job matching, and interactive data visualisation is considerably reliant on these metrics. Standardized beta coefficient compares with each independent variable's influence on the dependent variable, in terms of strength.

The significant for each of the independent variables which are make job easier, IoT and good management are all below than 0.05 which for the make job easier the significant number is 0.002 which is below than 0.05 which is acceptable. For the next variable which is IoT the significant number is 0.012 which is also below than 0.05 is acceptable. Finally, for the good management the significant. number is 0.001 which is below than 0.05 is acceptable.

4.6 Hypothesis Testing

The probability of a concept is tested using sample data in a process known as hypothesis testing. In based on currently available facts, the test offers proof that the hypothesis is possible. By measuring and analysing a representative sample of the population under study, statistical analysts evaluate a hypothesis. Table 7 below shows the results of hypothesis testing.

Table 11: Results of Hypothesis Testing

Hypothesis	Analysis	p-Value	Support/Not Supported
H1: There is a significant relationship between make job easier and crops harvesting improvement.	Pearson correlation matrix	.002	Supported
H2: There is significant relationship between IoT and crops harvesting improvement.	Pearson correlation matrix	.012	Supported
H3: There is a significant relationship between management efficiency and crops harvesting improvement.	Pearson correlation matrix	.001	Supported

(Result from SPSS output)

4.7 Summary

The current chapter of the paper provides an overview of the statistical techniques used to analyze the data for hypothesis testing. Pilot study formed the basis of the statistical method. The measurement was then validated using convergent and discriminating validity analysis. The model was examined. The data provided sufficient values for calculation validity to proceed to the structural model. The association between the variables was tested in the current study using SPSS software. Results indicated that this investigation looked at three different theories. Three theories in all were confirmed.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 Introduction

In chapter 5, the researcher will presents the summary of the findings from the previous chapter. This is to know whether the researcher's objective is archive or not archive. In this chapter the researcher will also give recommendations and conclusions. The problem statement for this particular study was the researcher saw that many farmers in Malaysia specially in Sabah are not familiar with the farming technologies and still going the conventional way. Therefore this is what making the farming activities running slow and the researcher thought that this is one of the problem what makes the crops production and harvesting slow.

5.2 Achievement of Research objectives

The researcher will elaborate the findings and the result for all objectives which are to analyze the significant relationship between effectiveness agrotechnology and crop harvesting improvement, to examine the correlation between effectiveness agrotechnology and the variables and finally to verify what is the most dominant among the existing variables for crops harvesting improvement.

5.2.1 Research Objective 1

RO1: To analyze the significant relationship between benefits agrotechnology implementation and crop harvesting improvement.

In this research objective 1, the researcher wants to analyze the significant relationship between benefits agrotechnology implementation and crop harvesting improvement. The significant relationship. The researcher used the regression data model which is R^2 to see how well the data fit the regression model. The range of multiple regression model is from 0 to 1 this will show the weak, moderate and strong variance. In table 7 it shows that the R^2 values is 0.544 which is moderate strong.

Agrotechnology is new specially to the people in Sabah that many people still do not have knowledge about agrotechnology through the previous chapter figure 4.1 the percentage of people that have knowledge about agrotechnology is only by 73 out of 125 people or 58.4% and for those who do not have knowledge about agrotechnology at 52 people or 41.6%.

For those who have the knowledge about agrotechnology they sure know that benefits agrotechnology implementation will have a good impact on crop harvesting improvement this is because agrotechnology use the latest technology that purposely for farming activities. The first benefit of agrotechnology implementation is make job easier, through the result that the researcher got most of the respondent are agree that agrotechnology make their farming activities much easier. Next, Internet of Things (IoT). IoT is equipment that connected to the internet and can be access anywhere as long there's internet connection and it helps farmers to get their job to run automatically. Finally, good management. Agrotechnology system can be set and it will not fail as long as there is internet and electric supply this will result a high production and good care of the plants because there is less human error in terms of measurement this will ensure good quality of the plants.

5.2.2 Research Objectives 2

RO2: To examine the correlation between effective agrotechnology implementation and the variables.

Research objective 2 the researcher wants to examine the correlation between effective agrotechnology implementation and the variables. Based on table 9, shows the result of

correlations between effective agrotechnology implementation and crops harvesting improvement. For make job easier, it has correlation with IoT, management efficiency and crops harvesting improvement. The result shows that for the IoT r-value = 0.615, management efficiency r-value = 0.709 and finally the crops harvesting improvement r-value at 0.654. From the survey that has been distributed 84 (67.2%) agree that machineries utilization increases jobs speed this is mean the job is much easier to accomplish.

Next IoT relationship with make job easier is 0.615, management efficiency at 0.658 and finally for crops harvesting improvement at 0.610. All the r-value show strong correlations. There are 73 (58.4%) people agree that modern farming method produces high harvesting rate. This is mean the IoT implementation with an effective and precise monitoring system can enhance the production of the crops harvesting.

Next, which is management efficiency. The relationship with make job easier is r-value = 0.709, IoT is 0.658, crops harvesting improvement is at 0.678. All the r-value show strong correlations. 70 (56%) strongly agree that it can ensure better crops quality with appropriate operation.

From the table 9 below it shows that crops harvesting improvement has relationship with make job easier, IoT and management efficiency. The Pearson correlation value for the make job easier is 0.654, IoT is 0.610 and management efficiency is 0.678 through the table 10 below shows the coefficient interval value to know whether it has very weak relationship to very strong relationship. For the correlation between crops harvesting improvement with make job easier, IoT and good management shows that all of it has strong relationship.

5.2.3 Research Objectives 3

RO3: To verify what is the most dominant among the existing variables for crops harvesting improvement.

Research objective 3 is to verify what is the most important among the existing variables for crops harvesting improvement. There are three variables which are make job easier, IoT and management efficiency. Table 10 show the T value of the three variables the highest t value is the most dominant which is management efficiency make job easier t-value is 3.134, IoT is 2.536 and finally management efficiency t-value is 3.521. Through the table 10

in page 41 it shows that management efficiency got the highest t-value which is 3.521 which means management efficiency is the most dominant.

5.3 Hypothesis

There are three hypothesis for this study which are for the hypothesis 1 there is a significant relationship between make job easier and crops harvesting improvement. Through the SPSS result it shows that the Pearson correlation analysis is significant by 0.002. If the number of the significant number is exceed 0.05 it is not supported but if the number is below than 0.05 the hypothesis is supported. Next hypothesis is there is a significant relationship between IoT and crops harvesting improvement is supported and significant by 0.012. Finally, there is a significant relationship between management efficiency and crops harvesting improvement is supported by significant number is 0.001.

5.4 Research contribution

This study is about the benefits if agrotechnology implementations in crops harvesting to the people in Sabah. This study is expected to open the mind of the people in Sabah about the importance to keep looking towards the future about implementing the agrotechnology this is because the researcher thinks that by implementing and adopting technology it can make the activities to be done faster and easier for the farmers. Therefore, there will be an improvement in terms of production. According to Ahmed (1993) nation's socioeconomic growth depends heavily on agriculture since it is a key component and factor in that development. Agriculture is the backbone of many economies.

Next, the researcher also expected to improve the knowledge of the people in Sabah about agrotechnology or at least know about the existing of the technology in agriculture. According to edge (Grant, 1996a, 1996b) It is the most priceless asset for building a long-lasting competitive. Knowledge is increasingly significant as a result of globalisation because it is closely related to other things which has crucial resource which is time (Ragab and Arisha, 2013). This is because through the questionnaire that has been distributed to 125 people there were many people that still do not know about the agrotechnology because there is lack of exposure about agrotechnology. Although, there are internet and television but there are still lack of promotion or advertisement about agrotechnology to encourage people to learn it.

Through the survey that has been distributed there are 91.2% or 114 people are interested to learn about the agrotechnology so the researcher hope that through this study it improve the people's knowledge in agriculture towards agrotechnology.

Finally, the researcher hopes that there will be many people realize that they can be an entrepreneur by involving themselves in agrotechnology. This is because the researcher believe that agrotechnology could maximize the crops production people can start to sell. Therefore, people in Sabah can earn more money and increase their income by being an entrepreneur in modern farming.

5.5 Recommendation for Further Research

The researcher would like to recommend a few things for future research which are to enlarge the scope of study. This particular study is focusing the people in Sabah only so the researcher would like to recommend a larger scope such as to include Sarawak and not Sabah only. This is because the researcher would like to see how well knowledgeable and the acceptance of agrotechnology from the people in Sabah and Sarawak and the researcher also wants to see the people in Sabah and Sarawak have the improvement in harvesting their crops by implementing agrotechnology in their farming activities. Next, to investigate what are the main obstacle that prevent the people who have knowledge in agrotechnology to start their own smart farming system.

5.6 Conclusion

In conclusion, this research aims about the benefits of agrotechnology implementation in crops harvesting to the people in Sabah. The survey has been distributed to 125 people in Sabah and the researcher used the Statistical Package for the Social Sciences (SPSS) to conduct this study. From the study the researcher found that make job easier, IoT and good management has the significant relationship with crops harvesting improvement. As a research model includes 3 hypothesis among variables which are H1: There is a significant relationship between make job easier and crops harvesting improvement, H2: there is a significant relationship between IoT and crops harvesting improvement and H3: there is a significant relationship between good management and crops harvesting improvement. All of these hypothesis are accepted by p-values are less than 0.05.

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APENDIX A

GANT CHART FYP 1

Tasks	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Journal or Article Reading															
Identify Research Title															
Information Processing (Chapter 1)															
Construct Chapter 1															
Information Processing (Chapter 2)															
Construct Chapter 2															
Information Processing (Chapter 3)															
Construct Chapter 3															
Prepare slide presentation															
Submission for Report and Slide Presentation															
Presentation For PSM 1															

APENDIX B

GANT CHART FYP 2

Tasks	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Discuss about Questionnaires															
Make correction															
Collect Samples for pilot study															
Run SPSS for pilot study															
Collect Samples															
Run SPSS for 125 samples															
Construct chapter 4															
Construct chapter 5															
Prepare slide presentation															
Submission for Report and Slide Presentation															
Presentation For PSM 2															

FACULTY OF TECHNOLOGY MANAGAMENT & TECHNOPRENEURSHIP

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

FINAL YEAR PROJECT

EFFECTIVE AGROTECHNOLOGY IMPLEMENTATION TOWARD CROP HARVESTING IMPROVEMENT

Researcher : Prinshielda Dyeaora Faddy

Matric No :

Year : Year 4

Contact No :

Email :

Supervisor : Dr. Kamarudin bin Abu Bakar

INTRODUCTION

The researcher has designed a survey questionnaire to collect information about the study entitled 'Effective Agrotechnology Implementations toward Crop Harvesting Improvement.'

The study focuses on the effectiveness of agrotechnology business is Sabah. In the internet era, it is critical to determine how much its implementation have really benefitted the industry in Sabah. The duration of the survey conducted will be for 4 weeks beginning 24 October 2022. Hence, the outcomes will be analysed by the Researcher and is expected to give latest update on the crops farming and harvesting achievement; in which some suggestions will be put forward to further improve the industry.

Respondents involved will be those who used to work or owned a farm; or those having knowledge, background, or experience about agrotechnology. Respondents are requested to fill up Section A, Section B, and Section C. All responses shall be kept with high level of confidentiality and shall be strictly utilised for the purpose of the study.

Please refer to the Researcher for further enquiries. Your kind attention, participation, and cooperation in the Final Year Project survey will be highly appreciated. Thank you!

QUESTIONARIES

SECTION A: DEMOGRAPHIC INFORMATION

This section will examine the demographic characteristics of the respondents. Answer all questions. For every question, tick on the appropriate answer.

1. **Gender**

☐ Female
☐ Male

2. Age

☐ 19 and below
☐ 26-35
☐ 36-50
☐ Above 51

3. Employment Sector

☐ Government
☐ Private Sector
☐ Self Employed
☐ Student
☐ Others _____

5.Do you have **knowledge** about agrotechnology?

☐ **Yes**
☐ **No**

6. Do you have any farming **experience?**

☐ **Yes**

☐ **No**

7. Do you have **interest** to be an entrepreneur in modern farming?

☐ **Yes**

☐ **No**

8. Are you **interested to learn** about agrotechnology?

☐ **Yes**

☐ **No**

SECTION B: INDEPENDENT VARIABLES

Instruction: This section items will examine 3 (THREE) independent variables of the study intent. Answer ALL questions. For every question, tick on the appropriate answer. Respondent's answers shall be based on the following indicators:

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

IV1: Make Job Easier

ITEM	Statements	1	2	3	4	5
1	**Improved watering system** simplifies farming activities.					
2	**Continuous feedback** about crops condition provides relevant information for **better operations.**					
3	**Machineries** (equipment) utilization **increases jobs speed.**					

IV2: Internet of Things (IoT)

ITEM	IoT	1	2	3	4	5

1	Automation implementation will enhance **good farming practices.**					
2	Crops require **effective monitoring system.**					
3	**Up to date** (Modern) farming method produces high harvesting rate.					

IV3: Management Efficiency

ITEM	GOOD MANAGEMENT	1	2	3	4	5
1	**Good Yield** (Productivity) will be increased with systematic farming.					
2	**Better quality** of crops is always achievable with the appropriate operation.					
3	It is always important to ensure **adequate supply** of water.					

SECTION C : DEPENDENT VARIABLE

Instruction : This section will examine the dependent variables of the study intent. Answer ALL questions. For every question, tick on the appropriate answer. Respondents answers shall be based on the following indicators:

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

DV: Crops Harvesting Improvement

ITEM	STATEMENTS	1	2	3	4	5
1	Technology implementation in farming will ensure **better output.**					
2	Improved facilities help **simplify activities** (process) for harvesting.					
3	It is important to satisfy consumers needs with **continuous supply** of crop products.					
4	**Shorter time** taken for harvesting season will improve the business.					
5	Effective farming technique **increases shelved life (Freshness)** of the harvested crops?					