YANGON UNIVERSITY OF ECONOMICS

DEPARTMENT OF STATISTICS

A STUDY ON CONTRACT FARMING OF PADDY PRODUCTION IN MYANMAR AGRICULTURAL SECTOR

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MAS - 33

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This thesis is submitted as a partial fulfillment towards
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ABSTRACT

This study aims to analyze the factors influencing the Contract Farming which is beneficial to farmers by using case study conducted in Nay Pyi Taw and Oak Twin Townships. Socioeconomic characteristics of farmers and input of contract farming were collected from 254 sample farmers using structured questionnaire. In this study, appropriate statistical analysis such as descriptive statistics, independent t test analysis and multiple regression are used. More than three-quarters of respondents have experience with contract farming in these tow townships. Based on the findings, it was found that contract farming strategy is more likely to have higher paddy yield by comparing with traditional farming method. Additionally, contract farming practice, broadcasting method of planting, seeder method of planting, urea fertilizer and canal water availability are found as major determinants of contract farming in order to raise the paddy yield production in Myanmar agricultural sector.

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LIST OF ABBREVIATIONS

CF	Contract Farming
FAO	Food and Agriculture Organization
FY	Fiscal Year
GAP	Good Agriculture Practices
GDP	Gross Domestic Product
MMT	Million Metric Ton
MOALI	Ministry of Agriculture Livestock and Irrigation
MRT	Myanmar Rice Trading Co., Ltd
USDA	United States Department of Agriculture
VIF	Variance Inflation Factor

CHAPTER I
INTRODUCTION

Myanmar is the country which based its main product in agricultural sector, and the whole economy backbone is depends on the agriculture. 37.8 % of gross domestic product (GDP) is contributes from the agriculture sector, and 25 to 30 % of total export earnings and 70 % of the labor force are from this sector. to establish a peaceful, modern and developed country, Myanmar has established 12 political, economic and social objectives in its efforts. One major economic objective is "Development of agriculture as a base and all-round development of other sectors of the economy as well" (FAO, 2015).

Rice is a priority crop and a national crop, so that it is very important for yield increase and area expansion. Myanmar started hybrid seed production in 2011 through the Development of Hybrid Rice in Myanmar Project conducted by FAO. To boost rice yield, MOALI laid down 14 guidelines for Good Agricultural Practices (GAP) and consequently, contract farming has become an attractive farming practice for the farmers since 2011.

1.1 Rationale of the Study

Since nearly 43 percent of the total agricultural production value is rice, it has been designated primary agricultural product. In Myanmar, about 70 % of people live in rural areas of the country's population and their livelihood drives the agriculture sector which is related to the rural development. In July 2016, a 12-points economic plan targeted at developing a market-oriented economy was announced by the Government. The Myanmar Government focuses on enhancing food security, increasing exports, strengthening farming production, and improving living standards of the rural population depends on farming as their first and key source of income (Framework, 2021).

Rice can be grown cross the country throughout the year, rice is the product can be grown. It is grown (80%) during the monsoon and (20%) summer seasons in four growing zones: coastal zone, the dry zone, the delta and mountainous areas. Overall country's rice production in Naypyitaw region at 19 percent, Ayeyarwady region at 29 percent, at about 17 % in the Bago region, at 13 % the Sagaing region and at 7% the

Yangon region and Shan state each (Framework, 2021). In 2011, the country opened the door to democratic economic transformation. One of the development goals is to increase rice exports while maintain domestic food security, and open borders trade.

However, the polders degraded and many of the polders were damaged due to 2008 cyclone Nargis, reducing rice yield because of resulting in the uncontrolled entry of salt water. As a result, even in the monsoon season, many of the damaged rice areas remain prone to salt water intrusion. Nowadays, because of mismanagement, population pressure, and poverty, among others, natural resource degradation is rampant. Moreover, such as increasing water scarcity, declining precipitation, flooding, growing frequency of extreme weather events and rising temperatures such climate changes are great challenges for the country and country has already suffered from these. These changes make a serious threat to agro-ecosystems and natural resources that underpin agriculture.

Since Myanmar is an agriculture-based country and rice is the key product to increase the country's GDP, farmers and their farming practice need to be upgraded. Practicing the contract farming across the country especially for paddy production is the solution to solve the above problems and lack of capital and technological know-how. Aside from lack of investment and technical know-how, small-scale farmers also have to struggle with crop quality and marketing difficulties for their produces. Contract farming companies can support them to solve all the problems and requirements. Cooperation with farmers will be the best scenario to develop the agriculture sector by government departments and companies.

Myanmar Rice Trading Co., Ltd (MRT) is one of the agriculture-based companies that doing rice trading and contract farming. For Contract Farming, MRT jointly cooperate with one of the Chinese Companies. Then the JV company contract with farmers interested in contract farming. Contract included inputs provided and the quote price of the paddy that MRT buy when it is cultivated. MRT provides the necessary inputs such as seeds, fertilizer, pesticides and financing to farmers. Moreover, MRT provide technology supports and monitoring to be effective production.

Hence, this study is aim to know the relationship between the traditional and contract farming method with paddy yield. This study will conduct how to provide the right inputs and efficient technology supports to the farmers, so they can produce more paddy yield and it will be more effective for both farmers and the company. Moreover, this study will also observe the farmers' perspective towards contract farming and what

they want to put in the contract with company. The result of the study will support for the better relationship between farmers and company and for effective productions.

1.2 Objectives of the Study

The objectives of the study are

(i) to describe the socioeconomic characteristics of farmers practicing contract farming

(ii) to compare the paddy yield of the farms practicing on the contract farming method with the traditional method.

(iii) to determine the effects of contract farming inputs on the paddy yield

(iv) to explore the farmers' opinion toward contract farming to develop a long-term sustainable business for both farmers and the company

1.3 Method of Study

This study used descriptive analysis to explore information about the contract farming of rice production and farmers. Independent of two sample t test was analyzed to inquire whether the paddy yield of the farms practicing the contract farming method is different from the yield of the farms using the traditional method. Multiple Linear Regression Model is constructed to make an inference about inputs of the contract farming method that is supportive for the farmers. Descriptive statistics was also used to explore the information of farmers' opinions toward contract farming.

1.4 Scope and Limitations of the Study

This study used the survey data of Myanmar Rice Trading Co., Ltd. The survey was conducted in 2020 included a sample of 254 randomly chosen farmers (70 in NPT and 184 in Oak Twin from 19 villages and 34 villages, respectively) who MRT aims to do contract farming. In addition, the study only focused on the effect of inputs and yield of hybrid rice with one-time data collection in two locations. Surveyors were used from the Yezin university students and fully time support from researcher was not provided due to Covid-19 situation.

1.5 Organization of the Study

This study is divided into six chapters. Chapter I consists of the introduction part, the rationale of the study, objectives of the study, method of the study, scope and

limitations of the study and organization of the study. Chapter II presents, the definition of contract farming and the related literature with some theoretical background and discussion. Chapter III describes Research Methodology. Chapter IV provides results and findings of contract farming. Finally, Chapter V discusses the conclusion based on the findings of the study, followed by recommendations and further studies.

CHAPTER II
LITERATURE REVIEW

This chapter describes the overview of contract farming such as meaning of contract farming, history of contract farming, business model of contract farming, contract types, advantages and problem of contract farming, conditions for success and failure of contract farming, contract farming in Myanmar, Thailand's contract farming in Myanmar, Bangladesh's contract farming in Myanmar, literature review of contract farming and conceptual framework.

2.1 Defining Contract Farming

Contract farming (CF) can is an agreement between farmers and company which provides the inputs, technical and sometimes at predetermined prices under forward agreements. The arrangement also consistently involves the company in providing production supports, such as, the supply of inputs, the provision of technical advice, the supervision and monitoring. The main objectives of such arrangements is a assurance on the part of the farmer to provide a specific quantities produces and at quality standards determined by the company and to support production technique and to purchase the paddy or rice (Thakur, 2021).

CF system should be seen as a partnership between the company and farmers. It requires a long-term commitment from farmers and the company to be successful collaboration. Farmers need to consider that honoring contractual arrangements is likely to be to their long-term benefit (Thakur, 2021).

CF is also defined as forward agreements specifying the obligations of farmers and buyers as partners in business. Legally, farming contracts involve the sellers' (farmers') obligation to supply the volumes and qualities as specified, and the buyers' (processors'/ traders') obligation to off-take the goods and realize payments as agreed (Will, 2011).

CF is becoming very important of agribusiness, whether the products are purchased by smaller companies, multinationals, farmer cooperatives, government agencies, or individual entrepreneurs (FAO, 2015).

CF is a joint undertaking linking the buyer's business model with the producers' business model (farming system) at the farm supply-firm procurement interface (Will, 2011).

2.2 Background Information of Contract Farming

Contract farming has been in practicing for many years by organizing the commercial agricultural production of both small-scale and large-scale farmers. Some countries that have liberalized marketing through the closing down of marketing that previously followed a central planning policy are interested in continuous to expand CF. Changes in consumption habits have also provided the impetus for further development of this mode of production such as the growing role played by supermarkets in many countries, the increasing number of fast-food outlets, and the continued expansion of world trade in fresh and processed products.(FAO, 2015).

The strength of the contractual arrangement differs according to the complexity and the depth of the requirements in each of the following three areas:

Market Provision: The farmers and company agree to terms and conditions for the quantity of products and predetermine the price of a crop or product;

Resource Provision: In combination with the marketing arrangements the company agrees to supply necessary inputs, including sometimes land preparation and technical supports;

Management Specifications: The farmers agree to follow instructions of production methods, uses of inputs, and way of cultivation and harvesting specifications (Thakur, 2021).

Contract Farming Business Models

There are five contract farming models that mostly founded in the world.

- Informal model
- Intermediary model
- Multipartite model
- Centralized model
- Nucleus estate model (Will, 2011).

Contract Types

Bijman (2008) said that there are generally three types of contract forms,

- Market specification (or marketing) contract
- Production management contract
- Resource providing contract (Will, 2011).

MRT (Myanmar Rice Trading Co., Ltd) company is one of the leading companies who introduced proper contract farming in Naypyitaw since 2016 and Ayeyarwady and Bago regions since 2018 with the following model.

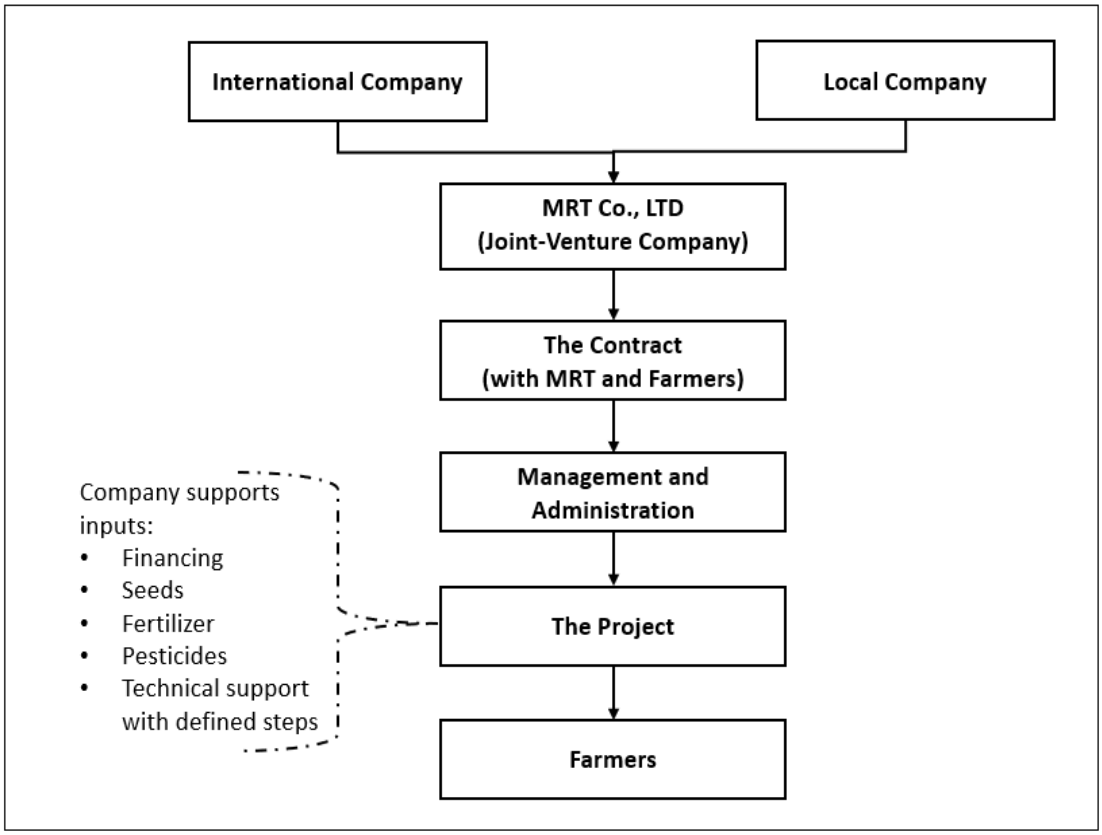

Figure (2.1) Organization's Functions of MRT Co., LTD

The main objective of the MRT was to improve the livelihoods of the local farmers by maximize their income as well as for organization's profit. Out of the four regions where MRT is doing contract farming for hybrid rice, Naypyitaw is the earliest and has most average yield rice production. Thus, this research planned to do the study on inputs and yield of hybrid rice by contract farming model in Naypyitaw and Oak Twin areas in Bago Region.

Through the proper research and survey, the company will have better understanding of the needs for inputs and improve the better model and technical

supports then can choose the more productive area for the contract farming project. Then, the company hope that it can also create the better trust from farmers.

2.3 Advantages and Problems of Contract Farming

Contract farming is benefits for both the farmers and the company. However, with these advantages also come difficulties.

Advantages for Farmers

- Inputs and production services are frequently supplied by the company
- Those supplies are done on credit before the production from the company
- CF sometime introduces new technology and also educate farmers to learn new skills
- Since CF specify prices in advance, farmers can reduce the price risk
- CF can reach to international markets which would otherwise be not available to small farmers

Problems faced by Farmers

- Farmers face the risks of lower price and production problems mostly when growing new crops,
- Quotas are manipulated and companies don't buy all contracted production because of inefficient management or marketing problems
- Famers can face with unreliable or exploit a monopoly CF company
- The employees of the CF company may be corrupt, especially in the buying products
- Because of excessive advances and production problems, farmers may become indebted

Advantages for Companies

- Contract farming with small farmers is more politically acceptable than, for example, production on estates
- Can avoid land constraints by working with many small farmers
- Quantity of products is more reliable than open-market purchases and the company faces less risk by not being supplied the guaranteed quantity to the buyers
- Quality can be fixed in advance and it is beneficial for the company to focus and sales plan

Problems faced by Companies

- Contracted farmers may face land constraints due to a lack of security of tenure, thus risking sustainable long-term operations
- Farmers' ability to produce according to the company's specifications may affected by social and cultural constraints
- Poor management and not enough support to farmers may lead to farmer dissatisfaction
- Farmers may sell to other buyers when the product is produced (extra-contractual marketing) thereby reducing quantity
- Farmers may mis-used inputs supplied on other purposes, thus reducing yields (FAO, 2015).

Conditions for Success and Failure of Contract Farming

As said at the onset of these guidelines, there is no blueprint for the design and operation of successful and sustainable contract farming arrangements. Rather, every single scheme calls for situation-specific design according to market opportunities, product features, suppliers' and buyers' capacities, existing business development services and the overall local, national, regional and international framework conditions for agricultural and agri-food business development and private investments. Accordingly, there is a vast range of conditions for success and failure that need to be taken into consideration when analyzing the situation on the ground and planning CF arrangements. And, equally important, right from the beginning, monitoring of performance and feedback loops have to be built in for early identification of problems and of appropriate solutions for the necessary modification of CF arrangements (Will, 2011).

2.4 Review on Related Studies

Narayanan. S (2011) studied the India's contract farming condition by the title of "Contract Farming as Frictional Equilibria: A Theoretical Perspective with Empirical Excursions in India". The author studied makes a case for theorizing contract farming as institutions that operate over a domain, rather than as mere technical arrangements for risk sharing between two economic actors (Narayanan, Contract Farming As

Frictional Equilibria: A Theoretical Perspective With Empirical Excursions In India, 2011).

According to the study of Narayanan.S (2011), such approach admits the possibility of incorporating the heterogeneity of contracting experiences, of incorporating the social aspects of transactions and acknowledging explicitly the dynamic elements of these arrangements. This study then assesses the welfare gains from participating in contracting, suggesting that there is considerable variation in outcomes, both across schemes and farmers within a scheme, providing the ingredients for churning in participation, or dynamics in a firm's portfolio of contract farmers over time. This study yields a few insights for policymaking in India. It is evident that there are some critical bottlenecks that prevent scaling up of schemes, chief of which are enforcement problems. In general, farm-firm relationships can be fragile and fraught with friction. (Narayanan, S. Contract Farming As Frictional Equilibria, 2011).

Bijman. J (2008) studied contract farming g in developing countries by quantitative method. This paper presents a review of the literature on contract farming (CF), focusing on recent empirical research on the economic impact of CF. It starts with an clarification of the phenomenon of CF, providing definitions, typologies, models and objectives. Using a Transaction Costs Economics framework, the paper explains for which products and market CF seems most suitable. Bijman. J (2008) founded that contract farming can be considered as transaction cost minimizing arrangement to organize the production and sales process between farmers and their customers. Particularly when vertical coordination between production activities on the one hand and processing/marketing activities on the other hand are required, spot market transactions lead to high transaction costs, due to (behavioral) uncertainty and/or specific investments (Bijman, 2008).

CF is an formal arrangement commonly adopted in agricultural production (see Roy, 1963; Glover and Kusterer, 1990; and Glover and Ghee, 1992). CF represents an agreement between companies and farmers (mostly exporters and/or processing firms) for the production and supply of agricultural products (Junning Cai, 2008). Under CF, farmers usually agree to deliver specific commodities in predetermined quantities and such specific quality standards, while companies agree to provide supports (e.g., supply of inputs and technologies) and buy paddy at predefined prices (Eaton and Shepherd, 2001).

Contract farming is beneficial to farmers because it can reach to international market otherwise unavailable for farmers (especially to smallholder farmers), providing inputs, technological and financial support, and monitoring system to reduce farming costs and the risks in lower selling prices and products. It also benefits to companies by allowing them to create close relationships with farmers and it can reduce uncertainties in procurement by predetermined quanity, prices, and quality standards (see Glover, 1984; Key and Runsten, 1999; Singh, 2002; and Setboonsarng, 2008).

While CF is a practically sound formal arrangement, very limited flexibility is one of its main liabilities, and management problems are faced during its implementation (see Glover and Kusterer, 1990; and Little and Watts, 1994). Contract farmers tend to encounter greater production risks when they often required to grow new crops or adopt unfamiliar farming techniques, (Key and Runsten, 1999). Because of unnecessary advances, farmers are also likely to face greater credit risks which tend to threaten the sustainability of their operations in the long run (see Glover, 1984; and Glover and Kusterer, 1990).

Supports from companies can reduce the above risks. However, overdependence on a company not only makes farmers less adaptive and later more vulnerable to economic shocks, but also can lessen their bargaining power in contract negotiations (Key and Runsten, 1999; and MacDonald et al., 2004). CF may also be not a good option for poor farmers in remote areas while it is good for farmers with extensive land with good infrastructure (Setboonsarng, 2008).

Contract execution is another major issue (Will, 2011). Farmers may breach the contract by diverting inputs supplied on credit to other purposes or selling outside the contract for higher prices, while companies may breach the contract (e.g., with unfair quality standards, low quality inputs, poor technical assistance, incomplete purchases, delayed payments, etc.) because of inefficient management or marketing problems (see Glover, 1984, 1987; and Singh, 2002).

2.5 Contract Farming in Myanmar

Myanmar, once known as not only “the world’s largest rice exporter” but also “rice basket of Asia” and in 2014, the country stood as the 7th largest global rice producer. Successive governments endeavored priority on rice sector in any agricultural policies, thus, rice exists as a strategic sector because wide spread utilization, creating income, contribution to country’s GDP and employment ratio in Myanmar. By

encouraging private sector participation for rice sector development, CF system was introduced by Rice export companies in Myanmar at the end of 2008. Some companies practice formal contracts with individual farmers while others apply informal or verbal contracts with led by key farmer with group of farmers. Under the rice contract farming system, companies provide seeds, fertilizers, financing and technical support as well as stable market access as compared to the traditional system. (San, 2020)

With 70% of Myanmar's population supported by agricultural associated employment and incomes, policies to lower poverty levels in this sector could extensively force a mainstream of the country's populace. Presently, of this populace, a predictable 32.7% stay behind under the country's poverty line, though critics have described this number as low (CIA World Fact Book, 2011). Myanmar is habitually referred to as the one time "rice basket" of Asia, time and again highlighting how far the agricultural and economic systems of Myanmar have fallen. This converted interest in the development of Myanmar's agricultural sector has the likely to reengage that past existence of agricultural liveliness. (Baker, 2011)

It is essential to highlight that contract farming is not a blanket tool and the positive circumstances of successful cases must be well thought-out within Myanmar's agricultural environment. Critics of contract farming highlight the de-facto inequality farmers are often put in by a contract, along with the significant risk it can place on already fragile farming environments in which farmers risk everything. Such risks could be exacerbated by Myanmar's agricultural policy and political climate. Yet, contract farming has been used with increasing frequency to meet the needs of small land holding farmers, and companies that have specialist or niche farming needs. These contracts have led to a range of benefits for both farmers and contracting companies. The recent agreement on the part of the new government to make agricultural development and poverty reduction policy goals, offers a space in which contract farming opportunities could support the small land hold farming sector of Myanmar's agricultural community. (Baker, 2011)

Since 1991, commercial plantation farming in Myanmar has drawn a range of investors from Myanmar's neighboring countries and has seen major land concessions offered in exchange for promises by contractors to bolster the country's food security. However, on the environmental or economic impacts of these projects for proper study was done, and circumstantial accounts indicate that many of these instances of commercial farming have embodied unequal, abusive and corrupt forms of contract

farming, and can negatively impact small land farmers or farmers already below the poverty line. (Baker, 2011)

In 1991 an effort was underway to shift Myanmar's economy from the previous socialist system towards a more market-oriented economy. That year a national scheme to increase large scale commercial entrepreneurial activity and investment in the country's agricultural sector was introduced. For companies wanting to cultivate large plots, up to 5000 acres were awarded, with a possible total expansion per application to 50,000 acres, by the Central Committee for the Management of Culturable Land, Fallow Land, and Waste Land. Groups awarded this land were granted a range of economic concessions including 30 year leases, automatic permission to export up to 50% of the crop (with the remained required to be sold domestically), tax exemptions for imported machinery, insecticides, and fertilizer; the provision of "no-cost" infrastructure for the operation (apparently built at the states' expense); and guaranteed access to, and the availability of loans, to entrepreneurs.3 However these large-scale contracts aiming to increase agricultural economic activity did not contain legal provisions concerning the relationship between farmers and contracting companies or land use. (Baker, 2011)

According to the United States Department of Agriculture (USDA) Grain and Feed Report of 2019, in Fiscal Year (FY) 2019-20, rice and corn production in Myanmar is forecast to increase due to expansion of planting areas. As increasing exports to China balance out decreasing exports to the European Union, Myanmar's overall rice exports are expected to be stable (Framework, 2021). Farmers increase planting acreage in anticipation of favorable weather and due to attractive prices, rice production in FY 2019-20 is forecast to increase. Overall rice exports of Myanmar in FY 2019-20 are forecast remain at the same level as FY 2018-19 at 3.0 MMT (Framework, 2021).

Rice remains as a strategic crop for socioeconomic development of Myanmar because it is the main food as well as export earnings in national economy and a source of employment opportunities. Government therefore reforms and implements various agricultural policies for the rice sector development as priority which includes encouraging private sector participation. Usage of poor-quality seeds, mixing large number of varieties which dilutes the quality of pre-processing paddy, limited post-harvest infrastructures, outdated rice mills, high production cost and marketing costs, ambiguous and arbitrary trade policy measures, poor paddy yield, and high logistics

costs are major blockages to smallholder rice farming and rice sector development in the Country (Fujii and Satyanarayan, 2015). since 2008 monsoon season, private rice exporters (RSCs) introduced the CF system along Myanmar's rice value chain especially in major rice growing areas of the country. CF system has been considered as one of the potential business models to link smallholders to the international export markets along the stable supply chain as well as an formal solution in the provision of inputs, finance and technical supports to resource poor smallholders. (San, 2020).

Thailand's Contract Farming in Myanmar

Thailand has also signed contracts for large swaths of northern Myanmar for farming projects, in which Thailand supplies inputs while Myanmar supplies "land and labor" (S.H.A.N, 2005). Farmers have reported having their land confiscated, supposedly to fight the planting of opium, but never received compensation or an opportunity to work different land. In 2005 a 2,000-acre contract for sugarcane was signed between Thailand and the state-owned Myanmar Sugarcane Enterprise near Bago Division. The project was apparently the first of its kind, with 100% Thai ownership over the project. Job creation was promised, but few details were provided to determine if these jobs were hired day labor or tenant farmers, or if the project functioned to promote the livelihoods of farmers involved (Xinhua, 2005). In the same year Myanmar and Thailand supposedly signed a contract for the growth of a range of crops on over 17.5 million acres of land in Shan and Kachin States. The state owned Yuzana Company apparently seized over 200,000 acres of land for the project (BLC, n.d). The Thai agro-giant The Charoen Pokphand (CP) Group, currently uses contract farming to grow and purchase maize, and a range of other crops used for their animal feed business, from farmers in Myanmar, allowing them to dominate the area with a 75% market share (Baker, 2011).

Myanmar Agribusiness Public Company Limited (MAPCO)

MAPCO was established in 2012 as the Public Company, fully-owned by private investors to mobilize public savings and to foster broad investment in agriculture and agro-based industries of Myanmar. MAPCO promises and promotes rice and agriculture sector development of Myanmar for sustainability and profitability in the interest of national food security. MAPCO is founded to increase demand for a business corporation to lead the private sector of Myanmar's rice industry. MAPCO

key objectives are to increase yield per acres, to reduce production cost, to product quality Agri-Products, to promote food safety and good agriculture practices (GAP), to setup community based farmers network practices, to upgrade farm land to modern farming system and to support lowest price guarantee. MAPCO is doing contract farming with farmers by forming farmer clusters, providing mechanization service and agrochemical service, supporting seeds and loans with lowest price guarantee. MAPCO stated that benefits of contract farming for farmers will be higher yield, lower production cost, lowest price guarantee, processing facilities and market access. Benefit of contract farming for companies will be quality rice, specific variety, product traceability and market share. (MAPCO, 2018)

2.6 Conceptual Framework

This study focuses on the impact of contract farming on paddy production. The contract farming characteristics or factors such as such as Contract Farming Practice, Crop land property, Panting Method- Wet seeding **(**broadcasting, transplanting, seeder), Planting Method – Dry seeding (rain-fed, irrigation), fertilizer utilizing per acre (compound, urea, rock powder and potash), Water availability (irrigation, canal water, wells water, rain water and river/stream water) are used as independent variable and yield per acre of paddy production as dependent variable. The following conceptual framework shows how Contract Farming effects the Paddy Production in Agriculture Sector of Myanmar.

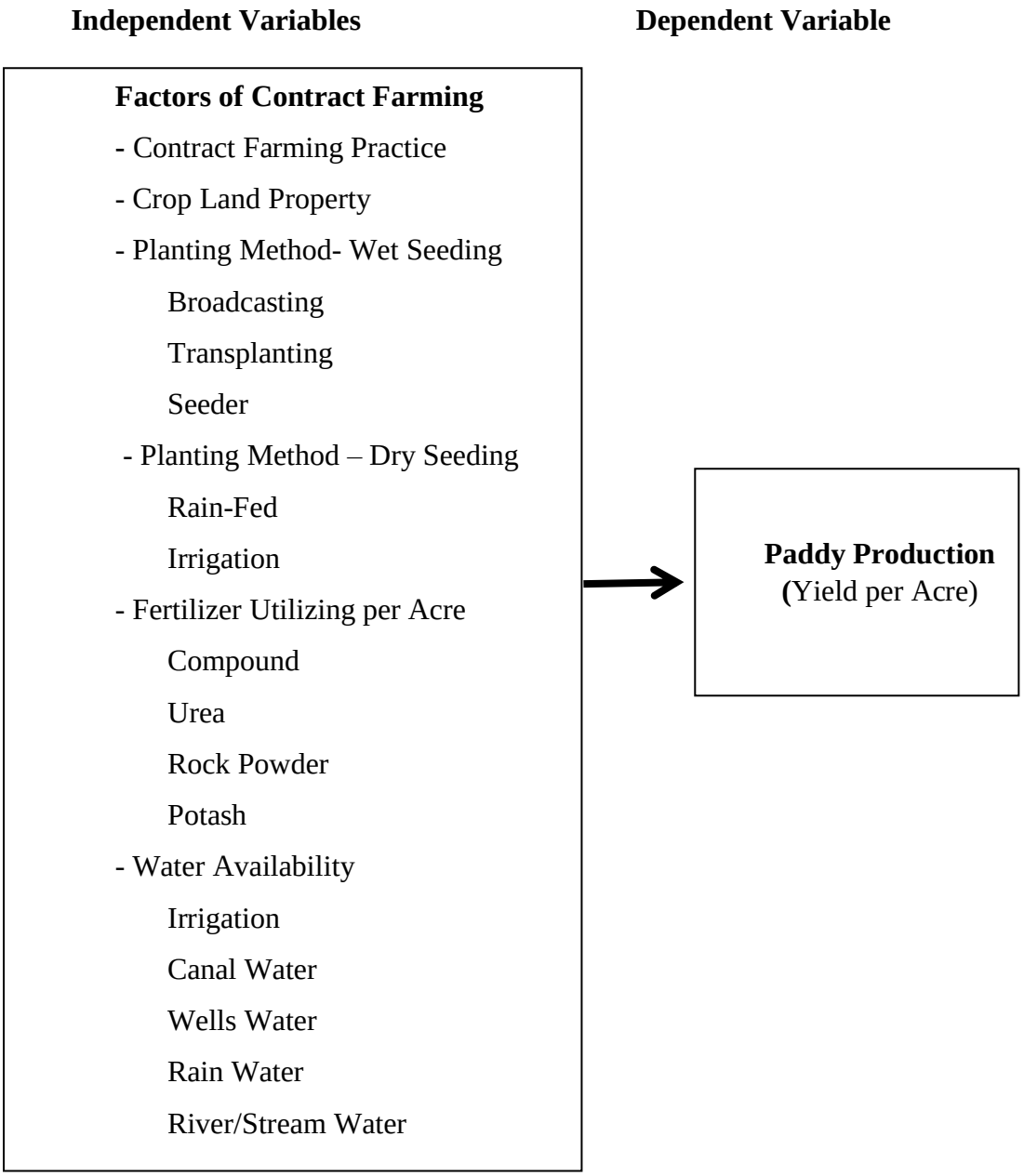

Figure (2.2) Conceptual Framework for Contract Farming of Paddy Production in Myanmar Agriculture Sector

CHAPTER III
RESEARCH METHODOLOGY

This paper intends to investigate whether the contract farming can support the farming sector of the developing countries such as Myanmar. Thus, the study attempts to inquire whether paddy yield of the farms practicing the contract farming method is different from the yield of the farms using the traditional method. To meet the study's objective, it presents both univariate analysis and multivariate analysis. In terms of univariate analysis, the study performs frequency distributions, measures of central tendency and variability.

With the help of these statistics, the paper displays the information about the contract farming. Meanwhile, the multivariate analysis seeks to make an inference whether the contract farming method is supportive for the farmers in order to increase rice production. In this section, methodology, independent sample t test, multiple linear regression, linear model, assumptions in multiple linear regression model, model specification, survey methods and control variables are presented.

3.1 Survey Design

3.1.1 Source of Data

Contract farming was conducted in Naypyitaw, Swar, Yaetarshae, Tuangoo, Oak Twin and Phyu townships in 2020 for 254 randomly chosen farmers. The questionnaires are focus for the contract farming practice, crop land property, farming method, usage of fertilizers and water availability. In additional, it covers farmers opinions towards contract farming and what they wants to put into the contract between farmers and the company. The criteria to select the research geographical areas are: 1) Must be irrigation area near Dams; 2) Must be same water in flow and out flow; 3) Must be within manageable area for administration; 4) Must be suitable for paddy cultivation; and 5) Must be good for production route.

Table (3.1) Area Selection for Contract Farming and Selection Criteria

Area Selection for Contract Farming	Criteria
(1) Napyitaw (Napyitaw, Lewe, Pyinmanar)	» Must be irrigation area near Dams » Must be same water in flow and out flow » Must be within manageable area for administration » Must be suitable for paddy cultivation » Must be good for production route
(2) Bago Division (Swar)	
(3) Bago Division (Yaetarshae)	
(4) Bago Division (Tanngoo)	
(5) Bago Division (Oak Twin)	
(6) Bago Division (Phyu)	

Source: Survey data (2020)

Based on the criteria, the research study was conducted in two areas: Naypyitaw and Oak Twin because those two areas are very close to the dams and regular water flow from dams, and the farmers have more knowledge about contract farming. Although Naypyitaw has 26 villages, the survey was conducted in 19 villages. Meanwhile, although Oak Twin has 47 villages, the survey was carried out in 34 villages. The sample villages were randomly selected. Form those villages, a total of 254 farmers (70 in NPT and 184 in Oak Twin) farmers were randomly chosen.

Table (3.2) Survey Villages at Naypyitaw

Sr. No	Village Name	Total Farmers	Sample Farmers	Dams
1.	Wat Kone	25	2	Kha Paung Dam
2.	Kyway Gan	122	11	Kha Paung Dam
3.	Ta lote Kone	34	3	Kha Paung Dam
4.	His Sone Kone	56	5	Kha Paung Dam
5.	Hlae Bu	27	3	Kha Paung Dam
6.	Pin Ya Kwin	42	4	Kha Paung Dam
7.	Oo Yin Taw	78	7	Kha Paung Dam
8.	Mae Kone	28	3	Kha Paung Dam
9.	Thayat Chin	20	2	Kha Paung Dam
10.	Wel Pyan Kwin	19	2	Kha Paung Dam
11.	Bago Lan	17	2	Kha Paung Dam
12.	A Nauk Kwin	9	1	Kha Paung Dam
13.	Kyat Thwin Khin (2)	12	1	Kha Paung Dam
14.	In Dine	33	3	Kha Paung Dam
15.	Hsee Phyu Kone	77	7	Kha Paung Dam
16.	Sin sate	25	2	Kha Paung Dam
17.	Kyway Pwal	30	3	Kha Paung Dam
18.	Kan Hla Taw	29	3	Kha Paung Dam
19.	Gone Min Dar	67	6	Kha Paung Dam
	Total	750	70	

Source: Survey data (2020)

Table (3.3) Survey Villages at Oak Twin

Sr. No	Village Name	Total Farmers	Sample Farmers	Dams
1.	Naung kone	87	8	Paung Laung
2.	Kyan Khin Su	35	3	Paung Laung
3.	Bo Ka Taw	48	4	Paung Laung
4.	Kan Bae Shan Ywar	122	5	Paung Laung
5.	Kyoe Tan	225	20	Paung Laung
6.	Myaung mya	172	13	Paung Laung
7.	Zee Phyu kone	13	1	Paung Laung
8.	Lat Pan Tan	8	1	Paung Laung
9.	Pauk Myaing	250	17	Paung Laung
10.	Yay Lal Pauk	275	18	Paung Laung
11.	Hsi Sone kone	12	1	Paung Laung
12.	Kone Paw Su	9	1	Chaung Ma Ngae
13.	Kyaung Yay	102	9	Chaung Ma Ngae
14.	Yay Oae Sin	24	2	Chaung Ma Ngae
15.	Shar Chaung	14	1	Chaung Ma Ngae
16.	Mway Yoe lay	16	1	Chaung Ma Ngae
17.	Khayan Kine	110	10	Chaung Ma Ngae
18.	Ywar Thit	29	3	Chaung Ma Ngae
19.	I Sauk	29	2	Yay Sin
20.	Moon Tae Khwin	42	4	Yay Sin
21.	Thet Hnin Inn	56	5	Yay Sin/ Excess Water
22.	Aung Zay Ya	34	3	Yay Sin/ Excess Water
23.	Inn Thar	46	4	A Wai Yar
24.	Thit saint Pin	123	8	A Wai Yar
25.	Zee Phyu Pin	66	6	A Wai Yar
26.	Paw San Khaw	21	2	A Wai Yar
27.	Phayar Kone	12	1	A Wai Yar
28.	Lay Ka Thein	78	7	A Wai Yar
29.	Kyauk Oae	37	3	A Wai Yar
30.	Aung Chan Thar	17	2	A Wai Yar
31.	Min Kone	5	1	Ngan Sat
32.	Za Laung	6	1	Ngan Sat
33.	Yay Ni Lay	87	8	Paung Laung
34.	Taung Sin Aye	146	9	Paung Laung
	Total	2112	184	

Source: Survey data (2020)

Although it is more convenient if farmers and other personals who are familiar with agriculture survey, some of the students from Yezin Agricultural University who have been trained to conduct the survey are not feeling well at Covid-19 period and other convenient personals did survey instead of them.

At the time of covid-19 outbreak in Myanmar, it was not allowed to enter the village and it was very difficult for the surveyor as well as researcher to travel from one place to another. And the villages do not allow people from other cities to enter their villages. Therefore, surveyors requested village leaders and key farmers to come out from the village and only those who came out were interviewed. As a result, there were some missing values for the analysis. Thus, the number of respondents is not equal from each variable to another.

The survey was conducted by face-to-face interview method with questionnaire form for all required data and information. Data were collected by own operation team and there was a limited management control of researcher. Researcher did some pre-discussion with farmers and pilot survey with few farmers to reduce error, misunderstanding and to conduct effective survey research.

3.1.2 Questionnaire Design

First, the survey question is a composite measure of a farmer's social condition. It can be collected data on a farmer's age, main occupation and household size. Second consideration is effective indicators, position and characteristics of economics on farms such as contract farming experience, crop land property, farming experience, farming measurement, the use of paddy seeds, planting methods, water availability and fertilizer utilization per acre.

The crop area has 7 response categories: 1 acre to 2.5 acres, 3 acres to 5 acres, 5.5 acres to 10 acres, 10.5 acres and 20 acres, 20.5 acres to 40 acres, and more than 40 acres.

Concerning planting method, the study takes 6 methods into considerations: Wet seeding (Broadcasting), Wet seeding (Transplanting), Wet seeding (Seeder), Dry seeding (Rain-fed) and Dry seeding (Irrigation).

Regarding fertilizer use per acre, the study takes account of 4 fertilizer types such as compound, urea, rock powder and potash. Its unit is bag. Water availability is measured by 6 categories: irrigation, canal water, wells water, rain water, and river/stream water.

3.2 Measurements and Categorization of Variables

Measurements and categorization of selected variables such as position and characteristics of economics on farms are presented in Table (3.4).

Table (3.4) Selected Variable for Contract Farming

Name	Variable Type	Responses
Paddy yield per acre	Continuous	Baskets
Contract Farming Practice	Categorical	"Yes" coded as "1"
		"No" coded as "0"
Age Group	Categorical	30 and under coded as "1"
		31 to 40 coded as "2"
		41 to 50 coded as "3"
		50 and above coded as "2"
Main Occupation	Categorical	Agriculture coded as "1"
		Livestock coded as "2"
		Selling coded as "3"
		Trading coded as "4"
Household Member	Categorical	Less than 5 coded as "1"
		5 to 10 coded as "2"
		Greater than 10 coded as "3"
Crop Land Property	Categorical	Less than 1 Acre coded as "1"
		1 to 2.5 Acre coded as "2"
		3 to 5 Acre coded as "3"
		5.5 to 10 Acre coded as "4"
		10.5 to 20 Acre coded as "5"
		20.5 to 40 Acre coded as "6"
		Above 40 Acre coded as "7"
Farming Experience	Categorical	Less than 2 years coded as "1"
		2 to 5 years coded as "2"
		6 to 10 years coded as "3"
		11 years and above coded as "4"

Table (3.4) Selected Variable for Contract Farming (Continued)

Name	Variable Type	Responses
Farming Management	Categorical	Self-farming coded as "1"
		Tenancy coded as "2"
		Lease coded as "3"
Paddy Seeds	Categorical	1 type coded as "1"
		2 types coded as "1"
		3 types coded as "1"
		4 types coded as "1"
Planting Method – Wet seeding (Broadcasting)	Categorical	"Yes" coded as "1"
		"No" coded as "0"
Planting Method – Wet seeding (Transplanting)	Categorical	"Yes" coded as "1"
		"No" coded as "0"
Planting Method – Wet seeding (Seeder)	Categorical	"Yes" coded as "1"
		"No" coded as "0"
Planting Method – Dry seeding (Rain-fed)	Categorical	"Yes" coded as "1"
		"No" coded as "0"
Planting Method – Dry seeding (Irrigation)	Categorical	"Yes" coded as "1"
		"No" coded as "0"
Fertilizer utilizing per acre – Compound	Continuous	Bags
Fertilizer utilizing per acre – Urea	Continuous	Bags
Fertilizer utilizing per acre – Rock powder	Continuous	Bags
Fertilizer utilizing per acre – Potash	Continuous	Bags
Water availability-Irrigation	Categorical	"Yes" coded as "1"
		"No" coded as "0"
Water availability-Canal water	Categorical	"Yes" coded as "1"
		"No" coded as "0"
Water availability-Wells water	Categorical	"Yes" coded as "1"
		"No" coded as "0"
Water availability- Rain water	Categorical	"Yes" coded as "1"
		"No" coded as "0"
Water availability- river/stream water	Categorical	"Yes" coded as "1"
		"No" coded as "0"

Source: Survey data (2020)

3.2.1 Control Variables in Multiple Regression

The selected variables were then incorporated in the multivariate regression model. The variables used for effective on paddy yields are contract farming practicing, crop land property, planting method (broadcasting, transplanting, seeder, rain-fed, irrigation/pond), fertilizer utilizing per acres (compound, urea, rock powder and potash) and water availability (irrigation, canal water, mineral water, rain water and river/ stream water). The set of variables used in regression model for determining of affecting on paddy production of two townships Naypyitaw and Oak Twin are presented in Table (3.5).

Table (3.5) Variables Description

Variables	Name	Variable Type	Responses
Dependent variables	Paddy yield per acre	Continuous	Baskets
Independent variables	Contract Farming Practice	Categorical	"Yes" coded as "1"
			"No" coded as "0"
Control variables	Crop land property	Categorical	"Yes" coded as "1"
			"No" coded as "0"
	Planting Method – Wet seeding		
	Broadcasting	Categorical	"Yes" coded as "1"
			"No" coded as "0"
	Transplanting	Categorical	"Yes" coded as "1"
			"No" coded as "0"
	Seeder	Categorical	"Yes" coded as "1"
			"No" coded as "0"
	Planting Method – Dry seeding		
	Rain-fed	Categorical	"Yes" coded as "1"
			"No" coded as "0"
	Irrigation/Pond	Categorical	"Yes" coded as "1"
			"No" coded as "0"
	Fertilizer utilizing per acre –		
	Compound	Continuous	Bags
	Urea	Continuous	Bags
	Rock powder	Continuous	Bags
	Potash	Continuous	Bags

Table (3.5) Variables Description (Continued)

Variables	Name	Variable Type	Responses
	Water availability-		
	Irrigation	Categorical	"Yes" coded as "1"
			"No" coded as "0"
	Canal water	Categorical	"Yes" coded as "1"
			"No" coded as "0"
	Wells water	Categorical	"Yes" coded as "1"
			"No" coded as "0"
	Rain water	Categorical	"Yes" coded as "1"
			"No" coded as "0"
	river/stream water	Categorical	"Yes" coded as "1"
			"No" coded as "0"

In this study, paddy is considered as dependent variable where respond variables are coded 'Yes' as '1' versus 'No' as '0'. The multiple regression model can be written as;

$$Y = \beta_0 + \beta_1 \text{CFP} + \beta_2 CLP + \beta_3 BP + \beta_4 TP + \beta_5 SP + +\beta_6 RP + \beta_7 IP + \beta_8 CF + \beta_9 UF + \beta_{10} RPT + \beta_{11} PF + \beta_{12} IWA + \beta_{13} CWA + \beta_{14} WWA + \beta_{15} RWA + \beta_{16} RSWA + \varepsilon \quad (3.1)$$

where,

Y = Paddy yield (baskets)

β_0 = Constant

β_i = Coefficients of the independent variables

X_1 = CFP = Contract Farming Practice

X_2 = CLP = Crop Land property

X_3 = BP = Broadcasting in Planting Method –Wet seeding

X_4 = TP = Transplanting in Planting Method –Wet seeding

X_5 = SP = Seeder in Planting Method –Wet seeding

X_6 = RP = Rain-fed in Planting Method – Dry seeding

X_7 = IP = Irrigation/Pond in Planting Method – Dry seeding

X_8 = CF = Compound Fertilizer utilizing per acre (Bags)

X_9 = UF = Urea Fertilizer utilizing per acre (Bags)

X_{10} = RPF = Rock powder Fertilizer utilizing per acre (Bags)

X_{11} = PF = Potash Fertilizer utilizing per acre (Bags)

X_{12} = IWA = Irrigation water availability

X_{13} = CWA = Canal water availability

X_{14} = WWA = Wells water availability

X_{15} = RWA = Rain water availability

X_{16} = RSWA = River/ Stream water availability

3.3 Independent Sample t Test

The two-sample t test is used to make inferences about the two populations from which the samples were drawn. **Two-sample tests** compare two sample estimates *with each other,* whereas one-sample tests compare a sample estimate with a nonsample benchmark (a claim or prior belief about a population parameter). To test the null hypothesis is H_0: $\mu_1 - \mu_2 = 0$. As always, the formula for the test statistic is determined by the sampling distribution of the sample statistic and whether or not know the population variances.

Unknown Variances but Assumed Equal

For the case where the value of the population variance is unknown but it has reason to believe they are equal. It allowed to *pool* the sample variances by taking a weighted average of s_1^2 and s_2^2 to calculate an estimate of the common population variance. Weights are assigned to s_1^2 and s_2^2 based on their respective degrees of freedom $(n_1 - 1)$ and $(n_2 - 1)$.

$$t = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{s_p^2}{n_1} + \frac{s_p^2}{n_2}}} \quad , \quad S_p^2 = \frac{(n_1 - 1)\, S_1^2 + (n_2 - 1)\, S_2^2}{n_1 + n_2 - 2} \tag{3.2}$$

Unknown Variances but Assumed Unequal

If the unknown variances σ_1^2 and σ_2^2 are assumed *unequal*, do not used pool the variances. Then uses a Student's *t* test is as follow.

$$t = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}} \tag{3.3}$$

3.4 Multiple Linear Regression

Regarding the multivariate analysis, the study employs the multiple linear regression model because the dependent variable of interest is continuous. The ultimate objective and in determining the probable form of the relationship between variables, Regression analysis is helpful. When this method of analysis is used, usually it is to predict or estimate the value of one variable corresponding to a given of another variables.

3.4.1 Multiple Linear Regression Model

It is considered the problem of regression when the study variable depends on more than one explanatory or independent variables, called a multiple linear regression model. Multiple regression analysis is a method of considering simultaneously the relationship between all the variables when two or more independent variables are to be used in making estimates of the dependent variable. The use of two or more independent variable regression analysis is an extension of the basic principles used in two-variable regression analysis. It is necessary to determine the equation for the average relationship between the variable.

In the linear equation that represents the multiple regressions model is

$$Y_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \cdots \beta_k x_{ik} + \varepsilon_i \quad (3.4)$$

where

Y_i = value of the dependent variable in the i^{th} trial, of observation

β_0 = constant in the regression equation, which indicates the value of y when all $x_{ij} = 0$

$\beta_1 \ldots, \beta_k$ = regression coefficients associated with each of the x_k independent variable

x_{ij} = value of the j^{th} independent variable in the i^{th} trial, or observation, associated with the process of sampling.

ε_i = the random error in the i^{th} trial or observation, associated with the process of sampling.

3.4.2 Assumptions of the Multiple Linear Regression Model

The following are the necessary assumptions underlying the multiple linear regression models when inference is an objective of the analysis:

1. The x_i may be either random or non-random (fixed) variables. Because of their role in explaining the variability in the dependent variable *y*, they are sometimes referred to as explanatory variables. The x_i is also some time referred to as predictor variables, because of their role in predicting y.
2. The independent variables, the x_i values, are measured without error.
3. For each combination of x_i values, there is a normally distributed subpopulation of *y* values.
4. The variances of the subpopulation of *y* values are all equal.
5. The *y* values are independent. This means that the value of *y* observed for one value of *x* does not depend on the value observed for another value of *x*.
6. The ε_i is normally and independently distributed with mean 0 and variance σ^2.
7. There is no flawless multicollinearity and no perfect linear relationships among the explanatory variables. Multicollinearity greatly increasing the standard error of the coefficients while may cause the statistical signs of the coefficients to be the opposite of what logic may recite.

3.4.3 Least Squares Method

The least squares method is used to develop the estimate regression model. The estimated ordinary least squares equation is written in a form to the multiple regression case:

$$\hat{y} = \hat{\beta}_0 + \hat{\beta}_1 x_1 + \hat{\beta}_2 x_2 + \cdots + \hat{\beta}_k x_k \tag{3.5}$$

The above ordinary least squares selects the estimates to minimize the sum of residuals squared.

$$\sum_{i=1}^{n} (y_i - \hat{\beta}_0 - \hat{\beta}_1 x_1 - \hat{\beta}_2 x_2 , \ \ldots - \ \hat{\beta}_k x_k)^2 \tag{3.6}$$

The minimization problem can be solved using multivariable calculus. This lead to k + 1 linear equation in k + 1 unknowns $\hat{\beta}_0, \hat{\beta}_1 , \ldots , \hat{\beta}_k$:

$$\sum_{i=1}^{n} (y_i - \hat{\beta}_0 - \hat{\beta}_1 x_1 - \hat{\beta}_2 x_2 - \cdots - \hat{\beta}_k x_k)^2 = 0$$

$$\sum_{i=1}^{n} x_{i1}(y_i - \hat{\beta}_0 - \hat{\beta}_1 x_1 - \hat{\beta}_2 x_2 - \cdots - \hat{\beta}_k x_k)^2 = 0$$

$$\sum_{i=1}^{n} x_{i2}(y_i - \hat{\beta}_0 - \hat{\beta}_1 x_1 - \hat{\beta}_2 x_2 - \cdots - \hat{\beta}_k x_k)^2 = 0$$

.

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$$\sum_{i=1}^{n} x_{ik}\left(y_i - \hat{\beta}_0 - \hat{\beta}_1 x_1 - \hat{\beta}_2 x_2 - \cdots - \hat{\beta}_k x_k\right)^2 = 0 \qquad (3.7)$$

These are often called the ordinary least squares first order conditions. The ordinary least squares first order conditions can be obtained by the method of moment, under assumption: *$E(\varepsilon)=0$ and $E(x_j\varepsilon)=0$, where $j=1,2, \ldots, k$* . The equation in (3.4) is the sample counterparts of these population moments, although the equation has omitted the division by the sample size n. Nevertheless, the modern computers running standard statistics and economics software can solve these equations with large n and k very quickly.

3.4.4 Testing for Significance

The significance tests of the simple regression model were the *t* test and the *F test.* In the simple regression model, these tests always generated the same conclusion. If the null hypothesis was rejected, concluded that $\beta_0 \neq 0$. In multiple regression, the *F* test and the *t* test have different determinations.

The *F* test is used to determine whether there exists a significant relationship between the dependent variable and the entire set of independent variables in the model; thus the *F* test is a test of the regression's overall significance .

If the *F* test shows that the regression has overall significance, the *t* test is then use to determine whether each of the individual independent variables is significant. A separate *t* test is used for each of the independent variables, thus the *t* test is a test for individual significance.

3.4.5 Test for the Significance of Overall Multiple Regression Model

The overall *F*-test is used to test for the significance of overall multiple regression model. The ANOVA method examine the null hypothesis that all the β-

value are zero against the alternative that at least one β is not zero. The multiple regression model is defined as

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_k + \varepsilon \quad (3.8)$$

The hypothesis for *F* test takes the following form

Null Hypothesis : $\beta_0 = \beta_1 = \beta_2 = ... = \beta_k = 0$

(there is no linear relationship between the dependent variable and the independent variables)

Alternative Hypothesis: At least one $\beta_j \neq 0$

(Linear relationship between the dependent variable and at least one of the independent variables)

If the null hypothesis is rejected, it is conclude that one or more of the parameters in the model is not equal to zero. Thus, the overall relationship between the dependent variable *y* and the independent variables x_1, x_2, …, x_k is significant. However, if the null hypothesis is not rejected, we conclude that there is an overall significant relationship and our regression does not significantly to explain the variation in the dependent variable.

This ration of mean square regression to mean square error follows the *F*-distribution when the assumption that the residents are normally distributed is valid and the null hypothesis is true. The ratio of *F*- statistic;

$$F = \frac{MSR}{MSE} \quad (3.9)$$

where; the MSR is the mean square due to the regression which is equal to

$$MSR = \frac{SSR}{k} \quad (3.10)$$

where; the MSE is the mean square of error which is equal to

$$MSE = \frac{SSE}{n-k-1}$$

where; $n - k - 1$ is the degrees of freedom and k is the number of independent variables. The decision rule for the *F*-test takes the following form;

Reject the null hypothesis if : $F > F_{\propto,k,n-k-1}$

Do not reject the null hypothesis if : $F \leq F_{\propto,k,n-k-1}$

where; $F_{\propto,k,n-k-1}$ is based on *F* the distribution with *k* degrees of freedom in the numerator, $n - k - 1$ degrees of freedom in the denominator, and a probability of α in the upper-tail of the probability distribution.

3.4.6 Test for Individual Partial Regression Coefficient, β_j

An individual partial regression coefficient, β_j in the multiple regression model is tested to determine the significance of the relationship between x_i's and *y*. For any parameter β_j the hypotheses take the form.

Null Hypothesis : $\beta_j = 0$

Alternative Hypothesis : $\beta_j \neq 0$

The *t* statistics for $\hat{\beta}_j$ is simple to compute given $\hat{\beta}_j$ and its standard error:

$$t = \frac{\hat{\beta}_j}{se\ (\hat{\beta}_j)} \tag{3.11}$$

The decision rule for this test takes the following form:

Reject the null hypothesis

$$\text{if} : t < -t_{\propto/2,n-k-1}$$

(or)

$$t > -t_{\propto/2,n-k-1}$$

3.4.7 Standard Error of Estimate

It shows how to choose an unbiased estimator of σ^2, which can obtain unbiased estimators of $Var\ (\hat{\beta}_j)$. Because an unbiased estimator of σ^2 is the sample average of the square errors: $n^{-1} - \sum_{i=1}^{n} \varepsilon_i{}^2$.

Nevertheless, the error can be written as $\varepsilon_i = y_i - \hat{\beta}_0 - \hat{\beta}_1 x_{i1} - \cdots - \hat{\beta}_k\, x_{ik}$. It replace each β_j with its OLS estimator, the $\varepsilon_i = y_i - \hat{\beta}_0 - \hat{\beta}_1 x_{i1} - \cdots - \hat{\beta}_k\, x_{ik}$. It seems natural to estimate σ^2 by replacing in the general ε_i with the $\hat{\varepsilon}_i$. The unbiased estimator of σ^2 in the general multiple regression case is

$$\hat{\sigma}^2 = (\sum_{i=1}^{n} \varepsilon_i{}^2)/(n-k-1) = \frac{SSR}{(n-k-1)} \tag{3.12}$$

The positive square root of $\hat{\sigma}^2$, denoted $\hat{\sigma}$, is call the standard error of the regression. The standard error of the regression is an estimator of the standard deviation of the error term. This estimate is usually reported by regression packages, although it is called different things by different packages. The σ^2 is also called the standard error of the estimate and the root mean squared error.

3.4.8 The Coefficient of Multiple Determination, R^2

The coefficient of multiple determinations is defined as:

$$R^2 = \frac{\sum(\hat{y}_i - \bar{y})^2}{\sum(y_i - \bar{y})^2} \tag{3.13}$$

The numerator of the middle term is the explained sum of squares, or the sum of squares due to regression, SSR, as it is sometimes called. The denominator is the total sum of squares SST. The subscription o$n\ R^2$ indicates the y is the dependable variable and $x_1, x_2, \ldots, x_k$ one independent variable.

Therefore, it can be written as:

$$R^2 = \frac{SSR}{SST} \tag{3.14}$$

The coefficient of multiple determination what proportion of the total variability in y, the dependent variables is explained by the independent variables. That is the percentages of the total variation of the dependent variable that can be explain by the explanatory variables. The value of R^2 will be between zero and one, where $R^2 = 0$, the regression model cannot explain anything about the variation in the department variable or the estimated model of the data. The case of $R^2 = 1$ represents a perfect fit of the estimated model of the data. A high value of R^2 shows good fit and a low value of R^2 shows a poor fit.

3.4.9 The Adjusted Coefficient of Multiple Determination, $\bar{R}^2$

A measure that recognized the number of independent variables in the regression model is called the adjusted coefficient of multiple determination and is denoted by $\bar{R}^2$.

$$\bar{R}^2 = \frac{\sum(y_i - \hat{y})^2}{(n-k-1)} \Big/ \frac{\sum(y_i - \bar{y})^2}{(n-1)} \tag{3.15}$$

Reporting the adjusted R^2 is extremely important in comparing two or more regression models that predict the same dependent variable but have a different number of independent variables.

3.5 Multicollinearity

Due to Ragnar Frisch (1934), the term multicollinearity is meant the existence of exact, or a perfect, linear relationship among some or all explanatory variables of a regression model. There are several sources of multicollinearity. As Montgomery and peck (1982) note, multicollinearity may be due to these factors. (1) The data collection

method employed, such as sampling over a limited range of the values taken by the regressors in the population. (2) Constraints on the model or in the population being sampled. (3) Model specification, for example, adding polynomial terms to a regression model, especially when the range of the *x* variable is small. (4) An over determined model.

Multicollinearity problem arises when one of the independent variables is linearly related to one or more of the other independent variables. Such a situation violates one of the conditions for multiple regression. Specially, multicollinearity occurs if there is a high correlation between two independent variables, x_i and x_j if the correlation coefficient r_{ij} between x_i and x_j in the multiple linear regression model is high, multicollinearity exist. Multicollinearity is a problem of degree. Any time two or more independent variables are linearly related, some degree of multicollinearlity exists. If its presence becomes too pronounced, the model is adversely affected. The presence of multicollinearity creates many problems in use of multiple linear regression model.

The most direct way of testing for multicollinearity is to produce a correlation matrix for all variables in the model. If a correlation is greater than 0.7 or less than -0.7, the independent variables are highly correlated. If a correlation is less than 0.5, it can be concluded that multicollinearity is not problem. Another way to detect multicollinearity is use to value of Tolerance. If the value of Tolerance is not less than 0.1, it can be said that there is no multicollinearity problem in this study. The third way to detect multicollinearity is to use the variance inflation factor (*VIF*). The *VIF* associated with any *x*-variable is found by regression it on all the other *x*-variables. The resulting R^2 is then used to calculate that variable's *VIF*. The *VIF* for any x_i represents that variable's influence on multicollinearity.

The *VIF* for any independent variable is a measure of the degree of the multicollinearity contributed by that variable.

The *VIF* for any given independent variable x_i is

$$VIF(x_i) = \frac{1}{1-R^2} \tag{3.16}$$

where, ${R_i}^2$ is the coefficient of determination obtained by regression x_i on all other independent variables. Multicollinearity produces an increase in the variation, or standard error, of the regression coefficient. *VIF* measures the increase in the variance regression coefficient over that which would occur if multicollinearity were not present.

In general, multicollinearity is not considered a significant problem unless the *VIF* of a single x_i measure at least 10 or the sum of the *VIF*'s for all x_i is at least 10.

Residual Analysis

Residual analysis refers to a set of diagnostic methods for investigating the appropriateness of a regression model utilizing the residual. If a regression model is appropriate, the residuals $\varepsilon_i = y_i - \hat{y}_i$ should reflect the properties ascribed to the model error terms ε_i. Since regression model assumes that the ε_i is normal random variables with constant variance, the residual should show a pattern consistent with these properties.

There are two graphical residual analysis methods. The first involves residual plots, where the residuals are plotted as a scatter plot against the corresponding fitted value. The second involves normal probability plots of the residual, where the ranked residuals are plotted against their expected values under normality.

Check for linearity Assumption

The use of the residual plots and normal probability plots for investigating the following departures from regression model are:

a. The regression function is not linear
b. The error terms ε_i not independent.
c. The distribution of *y* are not normal; or, equivalently, the ε_i is not normally distributed.
d. The distribution of *y* does not have constant variances at all level of *x*; or, equivalently, the ε_i does not have constant variance.

A plot of the residual against the fitted values also provides information as to whether or not the error terms ε_i have constant variance. If the error term variance is constant, the residual plot should show the residuals falling within a horizontal band around the central line. To check whether the linearity assumption, residual plot is can be drawn. If the residual plot has in straight line structure, the regression model is linear. If the residual plot has in curve nature, the regression model is nonlinear which is shown in Figure (3.1).

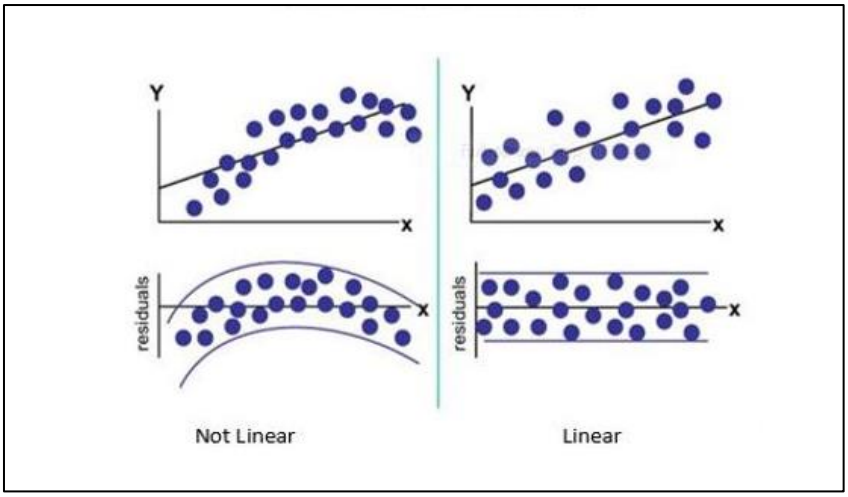

Figure (3.1) Residual Analysis for Linearity

Residual Analysis for Independence

The residual analysis for independence is shown in Figure (3.2).

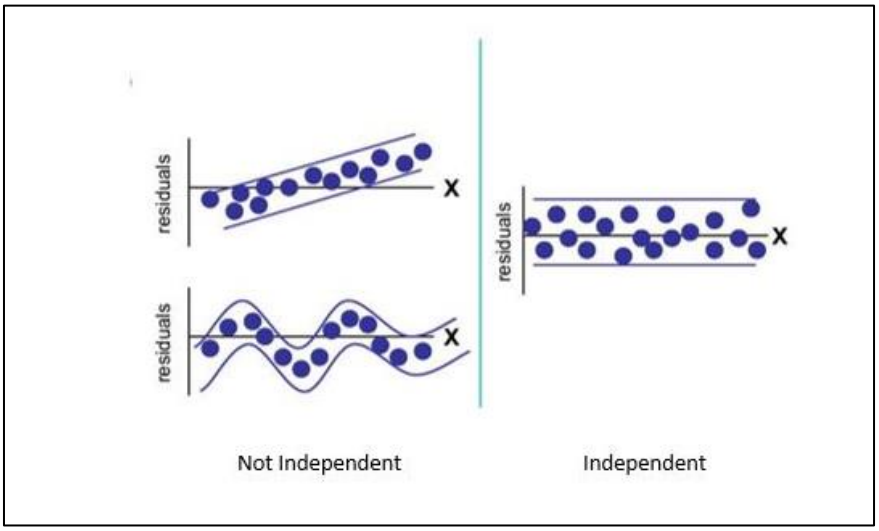

Figure (3.2) Residual Analysis for Independent

Residual Analysis for Normality

To check for normality, several methods are used in statistics. They are

1. the stem-and-leaf display of the residuals.
2. the box plot of the residual
3. the histogram of the residual
4. a normal probability plot of the residual

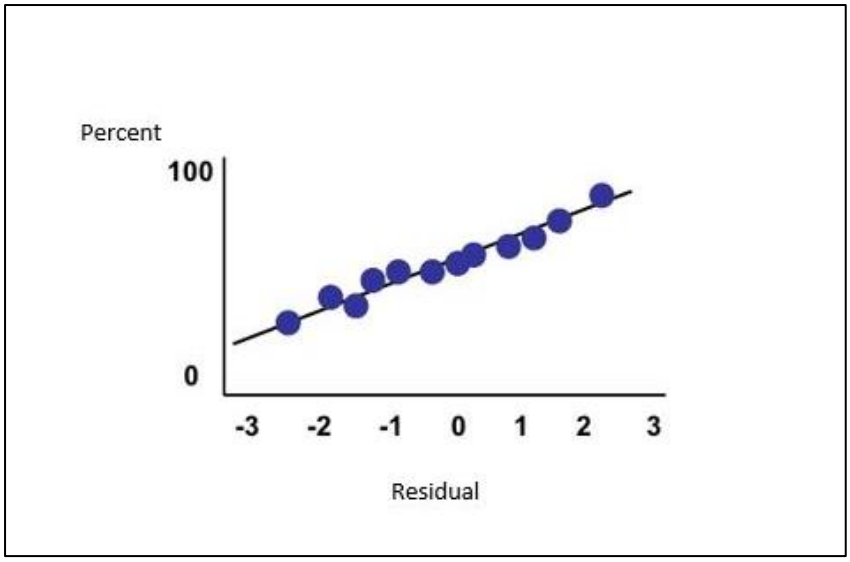

Figure (3.3) Residual Analysis for Normality

In this study, examine the histogram of the residual and construct normal probability plot of the residuals are used for checking the normality assumption. When using a normal probability plot, normal errors will approximately display in straight line which is shown in Figure (3.3).

Residual Analysis for Homoscedasticity

To check whether the constant variance, one can examine the residual plot. The Figure (3.4) is shown the residual analysis for equal variance.

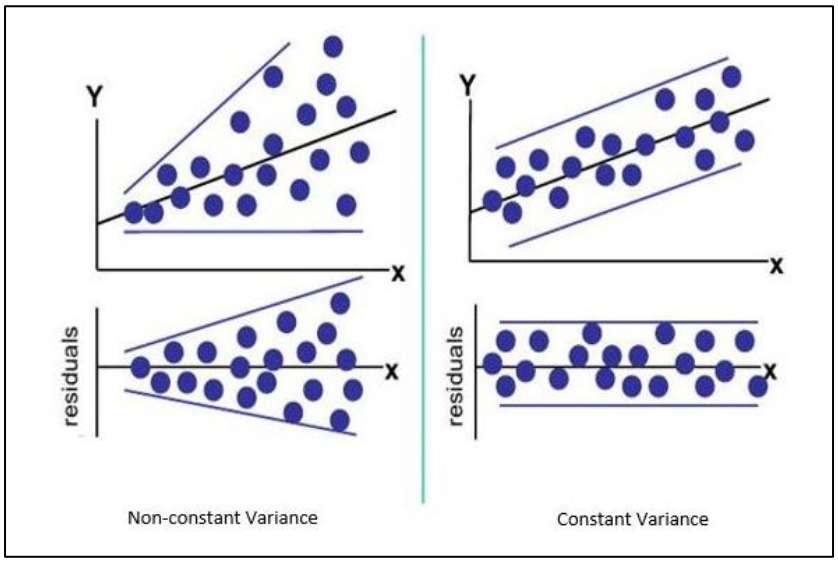

Figure (3.4) Residual Analysis for Equal Variance

Test for Serial Correlation

Durbin-Watson test will now be considered as a test of the null hypothesis that no serial correlation is present $(\rho = 0)$. The alternative hypothesis can be that ρ is nonzero or in the one-tailed case, that ρ is positive or negative.

The Durbin-Watson test involves the calculation of a test statistic based on the residuals from the ordinary lest squares regression procedure. The statistic is defined as

$$\text{Durbin-Watson } = d = \sum_{t=1}^{n}(\hat{\varepsilon}_t - \hat{\varepsilon}_{t-1})^2 \,/\, \sum_{t=2}^{n} \hat{\varepsilon}_t^{\,2} \qquad (3.17)$$

Range of the Durbin-Watson Statistic

Value of DW	**Result**
4 - $d_L < DW < 4$	Reject null hypothesis ; negative serial correlation present
4 - $d_U < DW < 4 - d_L$	Result indeterminate
$2 < DW < 4 - d_U$	Accept null hypothesis
$d_U < DW < 2$	Accept null hypothesis
$d_L < DW < d_U$	Result indeterminate
$0 < DW < d_L$	Reject null hypothesis ; positive serial correlation present

A great advantage of the *d* statistics is that it is based on the estimated residuals, which are routinely computed in regression analysis. Because of this advantage, it is now a common practice to report the Durbin-Watson *d* along with summary statistics such as R^2, adjusted R^2, *t*-ration, etc. Although, it is now used routinely, it is important to note the assumption underlying the *d* statistics:

a. The regression model includes an intercept term. If such term is not present, as in the case of the regression through the origin, it is essential to return the regression including the intercept term to obtain the *RSS*.
b. The explanatory variables, the *x*'s, are no stochastic, or fixed in repeated sampling.
c. The disturbance ε_i are generated by the first-order autoregressive scheme: $\varepsilon_i = \rho\, \varepsilon_{t-1} + u_t$. (3.18)

d. The regression model does not include lagged value(s) of the dependent variable as one of the explanatory variables. Thus, the test is inapplicable to models of the following type:

$$y_t = \beta_1 + \beta_2 x_{2t} + \beta_3 x_{3t} + \cdots + \beta_k x_{kt} + \gamma Y_{t-1} + \varepsilon_t \quad (3.19)$$

where y_{t-1} is the one-period lagged value of y. Such models are known as autoregression models.

e. There are no missing observations in the data.

CHAPTER IV
RESULTS AND FINDINGS

In this chapter**,** the results of descriptive statistics are presented based on survey data. The next part describes the determinants of contract farming by using pair sample t test and multiple regression model.

4.1 Socioeconomic Characteristic of Farmers

4.1.1 Respondent Profile

Table (4.1) presents the respondents of farmer members' profile such as age group, their main occupation, and household member. Nearly half of them, 48.0 %, are 50 and older; about 29 % is at ages of 41 to 50; and 1% whilst those who are no answer have the lowest proportion.

In the occupation question almost all of them, 86.6 %, mainly work at agricultural sector. Nevertheless, one respondent said that they work at livestock; one respondent sells; and one is trading. Where number of no answer is 31 %.

As shown in the table, respondents responded to the household member question. The respondents with 5 to 10 household members have the highest proportion, about 51% and followed by those with less than 5, exactly 48 %.

Table (4.1) Results of Respondent Profile

Characteristics	Number of Respondents	Percent (%)
Age Group		
30 and under	8	3.1
31 to 40	47	18.5
41 ot 50	74	29.1
50 and above	122	48.0
Missing Value (no answer)	3	1.3
Total	254	100

Table (4.1) Results of Respondent Profile (Continued)

Characteristics	Number of Respondents	Percent (%)
Main Occupation		
Agriculture	220	86.6
Livestock	1	0.4
Selling	1	0.4
Trading	1	0.4
Missing Value (no answer)	31	12.2
Total	254	100
Household Size		
Less than 5	122	48.0
5 to 10	130	51.2
Greater than 10	1	0.4
Missing Value (no answer)	1	0.4
Total	254	100

Source: Survey data (2020)

4.1.2 Farming Profile

In Table (4.2), presents 254 respondents answered the contract farming experience question. More than three-quarters of them have experience with contract farming.

Concerning property of crop land, one-third of them have land with 5.5-to-10-acre and it was found the highest, secondly followed by those who have land acre 3 to 5 and thirdly by land acre 1 to 2.5. Those who own above 40 acres are found the lowest number.

To the years of farming experience question, more than two-thirds of them, 73.2 %, have been working at farming since last 11 years and above. Those with 6-to-10-year farming experience are found the second highest and its proportion is 12.6 %.

Regarding farming management, respondents answered that question and almost all are doing self-farming. Although there were farmers who were practicing tenancy and lease, it is found relatively low.

Respondents replied to the question related to the paddy seed they use to plant. 34.3% of them utilized 2 types of paddy seeds and it was the highest proportion. It was followed by 33.5% who utilized 3 types of paddy seeds.

Missing values are represented for the numbers who did not answer the questions. The surveyors did tried the best to get answers but due to the covid-19 break out, the farmers did not want to spend time with outsiders (surveyors) since they are afraid of getting infected and hurried to finish the questioners.

In terms of planting methods, the study includes two methods which are wet seeding and dry seeding. Again, there are 3 wet seeding methods, namely broadcasting, transplanting and seeder. Out of those methods, broadcasting method is mostly used and it was followed by Seeder methods whilst transplanting method is less utilized. Dry seeding has two methods, namely rain-fed and irrigation. Among 2 dry seeding methods, Rain-fed method is mostly used which is 94.1% and irrigation method is used very low which is 7.1%. Those dry seeding methods are relatively less practiced than the wet seeding methods.

Regarding water availability, irrigation has the largest proportion which is 92.9% and rain water available are 9.4% followed by wells water and canal water, 7.9% and 5.9% respectively whilst river/stream water has the lowest.

For the fertilizers, urea is mostly utilized which is for average usage of 1.39, and followed by compound which is for average 51 whilst potash is found least.

Table (4.2) Results of Farming Profile

Characteristics	Number of Respondents	Percent (%)
Contract farming Experience		
Yes	198	78.0
No	56	22.0
Total	254	100
Crop land property		
1 to 2.5 Acre	55	21.6
3 to 5 Acre	68	26.8
5.5 to 10 Acre	81	31.9
10.5 to 20 Acre	42	16.5
20.5 to 40 Acre	5	2.0
Above 40 Acre	3	1.2
Total	254	100

Table (4.2) Results of Farming Profile (Continued)

Characteristics	Number of Respondents	Percent (%)
Farming Experience		
Less than 2 years	2	0.8
2 to 5 years	9	3.5
6 to 10 years	32	12.6
11 years and above	186	73.2
Missing Value (no answer)	25	9.9
Total	254	100
Farming Management		
Self-farming	223	87.8
Tenancy	1	0.4
Lease	7	2.8
Missing Value (no answer)	23	9.0
Total	254	100
Paddy seeds		
1 type	21	8.3
2 types	87	34.3
3 types	85	33.5
4 types	21	8.3
Missing Value (no answer)	40	15.6
Total	254	100
Planting Method-Wet Seeding		
Broadcasting answered (Yes) out of 254	128	50.4
Transplanting answered (Yes) out of 254	41	16.1
Seeder answered (Yes) out of 254	94	37.0
Planting Method – Dry seeding		
Rain-fed answered (Yes) out of 254	239	94.1
Irrigation answered (Yes) out of 254	18	7.1

Table (4.2) Results of Farming Profile (Continued)

Characteristics	Number of Respondents		Percent (%)
Water availability			
Irrigation answered (Yes) out of 254	236		92.9
Canal water answered (Yes) out of 254	15		5.9
Wells water answered (Yes) out of 254	20		7.9
Rain water answered (Yes) out of 254	24		9.4
River/stream water answered (Yes) out of 254	2		0.8
Fertilizer utilization per acre (in bags)	**Average**	**S.D**	**Min:Max**
Compound	0.60	0.51	0.0,3.00
Urea	1.39	0.93	0.0,12
Rock powder	0.46	0.82	0.0,6.0
Potash	0.18	0.32	0.0,1.0

Source: Survey data (2020)

4.2 Comparison between the Contract Farming and Traditional Practice

To investigate the effectiveness of contract farming strategy in farming sector, the study firstly conducted the two yield between traditional practice and contract farming practice without controlling other factors. To compare between the two yields with qualitative independent variable, the study carried out the independent sample t-test. Independent sample t-test is a statistical technique that is used to analyze the mean comparison of two independent groups in order to determine whether there is statistical evidence that the associated population means are significantly different where the yield production are different from traditional practice and contract farming practice.

As shown in Table (4.3) all two methods can reject the hypothesis of equal means with significances. That is paddy yields are varied from traditional practice to contract farming practice with statistical significance at 1% level regardless of assumption about variances. Those who are practicing contract farming strategy are more likely to have higher paddy yield.

Table (4.3) Comparison between the Paddy Yield of Contract Farming Practice and that of Traditional Practice

Model Fit	Equal Variances Assumed	Unequal Variances Assumed
t -test	-8.631***	-5.289***
p-value	0.000	0.000
df	252	58.350
Std. Error Difference	4.103	6.696
F –test (Levene's Test)	215.796***	-
Mean Difference	-35.413	-35.413
95% Confidence Interval of the Difference	(-43.493, - 48.814)	(-27.332, - 22.012)

***denotes significant at 1% level.

Source: Own computation (2022)

4.3 Determinants of Yield per Acre on Contract Farming

In this section, the application of multiple linear regression model demonstrated based on survey data. The value of paddy production is used as dependent variable and Contract Farming Practice, Crop land property, Panting Method- Wet seeding **(**Broad-casting, Transplanting, Seeder), Planting Method – Dry seeding (Rain-fed, Rain-fed/irrigation), fertilizer utilizing per acre (compound, urea, rock powder and potash), Water availability (irrigation, canal water, mineral water, rain water and river/stream water) are used as independent variable. Each category is a dummy variable. The results of regression model for Contract Farming of Rice Production in Myanmar Agriculture Sector are presented in Table (4.4).

Table (4.4) Determinants of Yield per Acre on Contract Farming

Variables	Coefficients	Std. Error	t-statistic	Sig.
Constant	72.422***	8.927	8.113	0.000
Contract Farming Practice	34.607***	4.173	8.292	0.000
Crop land property	-1.353	1.574	-0.860	0.391
Planting Method- Wet seeding				
Broadcasting	-11.778***	3.507	-3.359	0.001
Transplanting	4.071	4.791	0.850	0.396
Seeder	9.487**	3.681	2.577	0.011
Planting Method – Dry seeding				
Rain-fed	-5.514	6.684	-0.825	0.410
Rain-fed/ Irrigation	-5.674	7.007	-0.810	0.419
Fertilizer utilizing per acre				
Compound	0.095	3.456	0.027	0.978
Urea	5.596***	1.814	3.085	0.002
Rock powder	-0.936	2.205	-0.425	0.671
Potash	7.478	5.773	1.295	0.197
Water availability				
Irrigation	8.763	6.635	1.321	0.188
Canal water	17.004**	7.520	2.261	0.025
Mineral water	7.458	6.604	1.129	0.260
Rain water	-7.837	5.919	-1.324	0.187
River/stream water	-25.035	19.993	-1.252	0.212
Model fit				
F -test	7.578***			
p-value	0.000			
Std. Error of Estimate	25.911			
R squared	0.339			
Adjusted R squared	0.295			

***denotes significant at 1% level and **denotes significant at 5% level.

Source: Own computation (2022)

The R^2 value of about 0.339 suggests that all inputs of contract farming explains about 34 percent of the variation in paddy production. Where the adjusted R squared is 0.295. Therefore as R^2 and adjusted R^2 as goodness of fit measures. The adjusted R-squared shows adding additional predictors improve in regression model. The *F* value of as much as 7.578 is significant at 1% that all inputs of contract farming have effect on paddy production. Then the mean yearly paddy production in this benchmark is about 72.422 baskets per acres.

The result indicates that contract farming practice is statistically significant at 1% level. It is found that paddy production is positively related to contract farming practice. That is holding the other levels at constant, on average accept of Contract Farming Practice is greater than no accept of Contract Farming Practice by about 34.607 baskets per acres for paddy yield.

In Planting Method- Wet seeding, Broadcasting and Seeder methods are significant at 1% and 5% level. That is holding the other levels at constant, on average accept of Broadcasting method is less than no accept of Broadcasting method by about 11.778 baskets per acres for paddy yield. Similarly, holding the other levels at constant, on average accept of Seeder method is greater than no accept of Seeder method by about 9.487 baskets per acres on the paddy production. Doing this, it is found that the actual mean production in the two methods are about 60.65 and 81.9 baskets per acres.

In fertilizer utilizing, the use of Urea fertilizer is statistically significant at 1% level. It is found that paddy production is positively related to the use of Urea fertilizer. That is holding the other levels at constant, on average accept of the use of Urea fertilizer is greater than no accept of Urea fertilizer by about 5.596 baskets per acres on the paddy yield.

In water availability, the use of Canal water is statistically significant at 5% level. It is found that paddy production is positively related to the use of Canal water. That is holding the other levels at constant, the average yearly production of those which are used of Canal is higher by about 17.004 baskets per acres. The actual average production of paddy is 89.43 baskets per acres.

4.4 Testing for the Assumptions about Multiple Regression in Paddy Production

To determine the violation of required assumption from multiple linear regression model for the volume of paddy production, the following procedures have been used.

4.4.1 Testing for Normality of Disturbances

One of the basic assumption is that disturbances are normally distributed with zero mean and constant variance. The Histogram of disturbances and the Normal plot of disturbances for the volume of paddy production are shown in APPENDIX. Histogram, Normal plot, it can be concluded that the normality assumption appears to be generally reasonable.

Another basic assumption of the multiple linear regression model is that the disturbances are independent of each other. In APPENDIX that can reveal information about the model by plotting disturbance.

This figure shows that there is no positive and negative autocorrelation because correlation between disturbances are not correlated.

Durbin-Watson test is used to determine whether the residuals were autocorrelated or not. The Durbin-Watson statistics is used to test the hypothesis of no autocorrelation. Figure (4.1) represents to determine if the null hypothesis of no autocorrelation is rejected or not rejected. For $\alpha = 0.01$or 1% level of significance, critical values for the Durbin-Watson *d* statistic are d_L= 1.665 and $d_U = 1.874$. Since D.W=1.672, the null hypothesis is not rejected and it is concluded that there is no evidence of autocorrelation. As a general rule, if d is close to 2, assume that autocorrelation is not problem. Therefore, DW statistic satisfied that there is no positive and negative correlation between disturbance terms in the paddy production model.

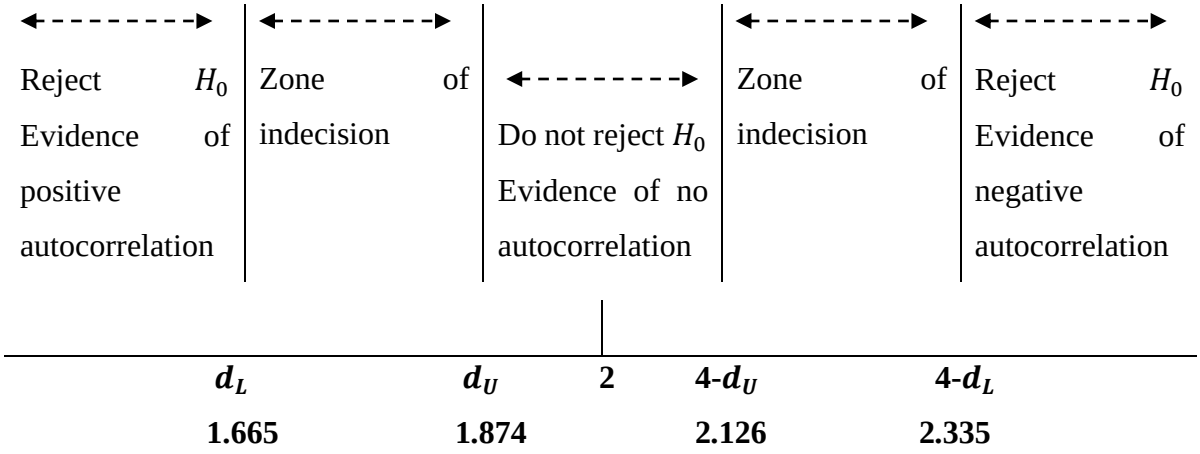

Figure (4.1) Durbin-Watson Statistic of the Volume of Rice Production

4.4.2 Testing for Homoscedasticity of Disturbances

One of the basic assumption of the multiple regression model is homoscedasticity. Heteroscedasticity can often be detected by plotting the estimated Y values against the disturbances. APPENDIX represents the predicted paddy production on x axis and the disturbance for paddy production on y axis. The figure can be seen that there is no residual pattern. Therefore, it can be concluded that residuals in paddy production has an equal variance or homoscedasticity.

4.4.3 Detecting Multicollinearity

The problem of multicollinearity, which is a problem of higher correlation among the independent variables in the model, is also assumed. This problem can also be deleted from the value of Tolerance and VIF (variance inflation factor). If the association among the independent variables is weak association and the value of the Tolerance is not less than 0.1 and the value of the VIF is not above 10, it is the indication of absence of multicollinearity problem.

According to the APPENDIX, among the independent variables, it is found that the collinearity statistics of the value of the Tolerance is not less than 0.1. The values of the VIF are less than 10. Therefore, it can be determined that there is no seriously multicollinearity problem in this model.

4.5 Farmers' Opinions towards Contract Farming

Farmers' perspectives are also very important for the performance of paddy production. It also effected to relationship between companies and farmers because if farmers are not satisfy on the contract farming, then they will stop doing it. Therefore, company needs to know what is their opinions on contract farming like as whether they are happy with inputs supports, technology supports, the profit, the terms they want to put in the contract. By knowing their opinions, the company can improve the system and develop the suitable strategy which will fit the most. Thus why, this study also focus on farmers' opinions towards contract farming. The following Table represents the final finding of these survey.

Table (4.5) Farmers Opinions towards Contract Farming

Sr. No	Description	Respondents	Percentage
1	Do you think Contract Farming is good? If yes, why?		
	- supports inputs	41	16%
	- supports technology	35	14%
	- it is profitable	30	12%
2	Did you stopped doing contract farming?	14	6%
3	If you do contract farming in the future, what you want to put in the contract?		
	- want to do with signed contract	61	24%
	- provide inputs by the company	41	16%
	- support land preparation cost in advance	35	14%

Source: Survey data in 2020

In Table (4.5) The question related to perceptions towards contract farming. Of them, top three responses are presented in this study. First question's answers of these three questions are as follows: 16% perceived that contract farming is good because it supports inputs; 14% said that contract farming is good because it supports technology; and 12% responded that it is profitable.

Second question's answer of these three questions is as follows: 14 farmers said that they stopped contract farming because the company did not buy paddy, said the

farmers to make the paddy dry without buying immediately, the company's instructions cannot be followed due to labor shortage, the company bought the paddy at lower price.

Third question's answers of these three questions are as follows: 24% said that they desire to do contract farming with a signed contract; 16% said that they want agreement to provide inputs by the company; and 14% said that they desire to make agreement to support land preparation cost in advance from the company's side. Besides, the farmers desire to include the following agreements: to increase market price to offer better buying price; to collect paddy from production route to increase seeds price and reduce the value price; to get good selling price; to offer better purchase price; to reduce input cost (e.g. compound); to offer better price than market price/ 1 Lakhs more; to get stable price because selling price is better than other verities; to provide technical support; to set buying price (floor price); to discuss and negotiate with farmers for their difficulties (Need to negotiate tractor price with operator); to guarantee price (require strong market); to get quality seeds; to provide monitoring for cultivation; to officer with floor price and market price; to weight the paddy with defined moisture; to include minimum yield in the contract; to take joint responsibility; to buy all the produced paddy; to pay for all transportation cost to Mill by the company; to mention the paddy purchase amount clearly; to weight with basket, not with weighting machine; and to keep some paddy for own eating.

CHAPTER V
CONCLUSION

This chapter includes findings of the study, recommendations, suggestions and further studies.

5.1 Findings

Contract Farming (CF) has been largely believed to have the ability to promote the chances of small-scale Farmers (SSFs) from less developed nations to participate in intensive agricultural production and profitable export markets, thereby integrating them into the latest way of doing agri-business. By the majority of authors, contract farming is a positive progress for agricultural revolution in developing countries, improving the chances of farmers productivity, quality and profit in regional and international markets. Contract Farming has become a prominent agricultural issue in most developing nations. Forces of change, such as globalization, "industrialization" of the agricultural sector and market reforms have paved the way to CF in many emerging countries and more in the world.

This study aimed to explore the inputs of contracting farming affecting Myanmar Agriculture Sector as well as to compare the different yield production between traditional farming and contract farming. The primary data used in this study are obtained from a total of 254 (70 in NPT and 184 in Oak Twin) farmers were chosen at random. Then, the background characteristics of these respondent farmers were also studied.

Nearly half of them, 48.0%, are 50 years and older. Moreover, 220 respondents (86.6%) mainly work at agricultural sector as their main profession. They represented nearly all of survey respondents. The respondents with 5 to 10 household members have the highest proportion, about 51% and followed by those with less than 5, nearly 48%. More than three-quarters of them have experience with contract farming. 81%, have been working at farming since last 11 years and above. Regarding farming management, almost all are doing self-farming.

The question related to the paddy seed they use for production, 34.3% of respondents utilized 2 types of paddy seeds and it was the highest proportion. It was followed by 33.5% who utilized 3 types. In terms of planting methods, broadcasting method is mostly used in wet seeding method. In dry seeding method, rain-fed is mostly used. Regarding water availability, irrigation has the largest proportion. For the usage of fertilizer inputs, urea is mostly utilized fertilizer.

To investigate the effectiveness of contract farming strategy in farming sector, it was found that practicing contract farming strategy is more likely to have higher paddy yield. The results of multiple regression model were described for the high yield in Contract Farming of Paddy Production in Naypyitaw and Oak Twin townships. In these two townships, a number of factors such as Contract Farming Practice, Broadcasting method, Seeder method, Urea fertilizer and Canal water availability are statistically and significantly associated with paddy yield when conducting a contract farming.

5.2 Recommendations and Suggestions

Contract farming is beneficial to farmers because it can access to an international market otherwise unavailable for farmers (especially to smallholder farmers), providing inputs, technical and financing support, and reducing farming costs and the risks of lower price in selling products. It also benefits companies by allowing them to establish close relationships with farmers and by reducing uncertainties in paddy purchases through predetermined timing, prices, and quality standards. Therefore, the companies can do pre-sales contract with international buyers and plan their trading volume effectively.

The study attempted to provide empirical evidence that contract farming is beneficial to farmers using a case study with 254 farmers in Naypyitaw and Oak twin townships. From the findings, it is found that contract farming can increase paddy yields. Moreover, other factors such as land property, farm management, farming methods, usage of fertilizers, water availability have relationship with yield production. Thus, the company should carefully consider for those above factors when they select area and the farmers. Some farmers stopped contract farming because the company did not buy all of the paddy as well as bought at lower price and due to labor shortage, the farmers could not follow the company's instructions. As a result, farmers produce less paddy yield who those have such mentioned issues.

Farmers' opinion towards contract farming will also impact on relationship with the company and farmers. Therefore, it is recommended that the companies should take those facts into consideration if they desire to increase their contract farming more acres and plan to upgrade for large scale contract farming called farm mechanization. In order to do farm mechanization, cooperation with large numbers of farmers are necessary. Besides, good cooperation and participation from farmers and they follow company's instructions will increase the production and quality of paddy. So, the company needs to build trust with farmers. In additions, the farmers should be favourable to do some agreements between them and the company. The key terms in the agreements they wanted to highlighted are to be contractual, to provide inputs and advance money for land preparation cost from companies.

5.3 Further Studies

In conducting this study, there are a few number of limitations. Among them, the non-response rate is significantly high, resulting in missing values which are represented for the questions which did not answer. There was selection bias because some villages did not allow the enumerators to conduct survey due to Covid-19 communicable disease. Additionally, unobservable factors such as weather can result in omitted variable bias and to reduce this bias, the further study should use the instrumental variables. The confirmation collected in this research is pointing out the increasing acceptance of Contract Farming and its advancement in the developing world, including Myanmar, as a tool for agribusiness promotion. It may be necessary to analyse new research to measure the income effects in specific instances of Contract Farming, particularly when it evaluates the effects of various well-specified service packages. Further study should carefully consider for village selection, farmers selection, seasonal corps practice, seeds variety and technical support. So that the study will define the more specific result of how contract farming related to paddy yield. Last, but not at least, the study should include the qualitative information like as the government support for farm land preparation, upgrading production road, irrigation system, funding and supports on G to G exporting to buyers countries to improve contract farming. With the intention of those information will support the knowledge of government's vision toward upgrading agriculture sectors and contract farming practice which company and set the relevant strategy.

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APPENDIX

Frequencies

Age_Group

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	30 and under	8	3.1	3.2	3.2
	31 to 40	47	18.5	18.7	21.9
	41 ot 50	74	29.1	29.5	51.4
	50 and above	122	48.0	48.6	100.0
	Total	251	98.8	100.0	
Missing	System	3	1.2		
Total		254	100.0		

Occupation_1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agriculture	220	86.6	98.7	98.7
	Livestock	1	.4	.4	99.1
	Selling	1	.4	.4	99.6
	Trading	1	.4	.4	100.0
	Total	223	87.8	100.0	
Missing	System	31	12.2		
Total		254	100.0		

HH_member_group

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 5	122	48.0	48.2	48.2
	5 to 10	130	51.2	51.4	99.6
	11 and older	1	.4	.4	100.0
	Total	253	99.6	100.0	
Missing	System	1	.4		
Total		254	100.0		

Crop land property

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 to 2.5 Acre	55	21.7	21.7	21.7
	3 to 5 Acre	68	26.8	26.8	48.4
	5.5 to 10 Acre	81	31.9	31.9	80.3
	10.5 to 20 Acre	42	16.5	16.5	96.9
	20.5 to 40 Acre	5	2.0	2.0	98.8
	Above 40 Acre	3	1.2	1.2	100.0
	Total	254	100.0	100.0	

Farming_Experience

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 2 years	2	.8	.9	.9
	2 to 5 years	9	3.5	3.9	4.8
	6 to 10 years	32	12.6	14.0	18.8
	11 years and above	186	73.2	81.2	100.0
	Total	229	90.2	100.0	
Missing	System	25	9.8		
Total		254	100.0		

Seeds

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	21	8.3	9.8	9.8
	2	87	34.3	40.7	50.5
	3	85	33.5	39.7	90.2
	4	21	8.3	9.8	100.0
	Total	214	84.3	100.0	
Missing	System	40	15.7		
Total		254	100.0		

Broadcasting

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	126	49.6	49.6	49.6
	Yes	128	50.4	50.4	100.0
	Total	254	100.0	100.0	

Transplanting

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	213	83.9	83.9	83.9
	Yes	41	16.1	16.1	100.0
	Total	254	100.0	100.0	

Seeder

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	160	63.0	63.0	63.0
	Yes	94	37.0	37.0	100.0
	Total	254	100.0	100.0	

Rain-fed

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	15	5.9	5.9	5.9
	Yes	239	94.1	94.1	100.0
	Total	254	100.0	100.0	

Rain_fed/Irrigation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	236	92.9	92.9	92.9
	Yes	18	7.1	7.1	100.0
	Total	254	100.0	100.0	

Irrigation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	18	7.1	7.1	7.1
	Yes	236	92.9	92.9	100.0
	Total	254	100.0	100.0	

Canal water

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	239	94.1	94.1	94.1
	Yes	15	5.9	5.9	100.0
	Total	254	100.0	100.0	

Wells water

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	234	92.1	92.1	92.1
	Yes	20	7.9	7.9	100.0
	Total	254	100.0	100.0	

Rain water

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	230	90.6	90.6	90.6
	Yes	24	9.4	9.4	100.0
	Total	254	100.0	100.0	

River/stream water

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	252	99.2	99.2	99.2
	Yes	2	.8	.8	100.0
	Total	254	100.0	100.0	

Statistics

		Compound	Urea	Rock powder	Potash
N	Valid	254	253	254	254
	Missing	0	1	0	0
Mean		.5967	1.3943	.463	.175
Median		.5000	1.5000	.000	.000
Std. Deviation		.51284	.93909	.8170	.3234
Range		3.00	12.00	6.0	1.0
Minimum		.00	.00	.0	.0
Maximum		3.00	12.00	6.0	1.0

T-Test

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Padd_yield	Equal variances assumed	215.796	.000	-8.631	252	.000	-35.413	4.103	-43.493	-27.332
	Equal variances not assumed			-5.289	58.350	.000	-35.413	6.696	-48.814	-22.012

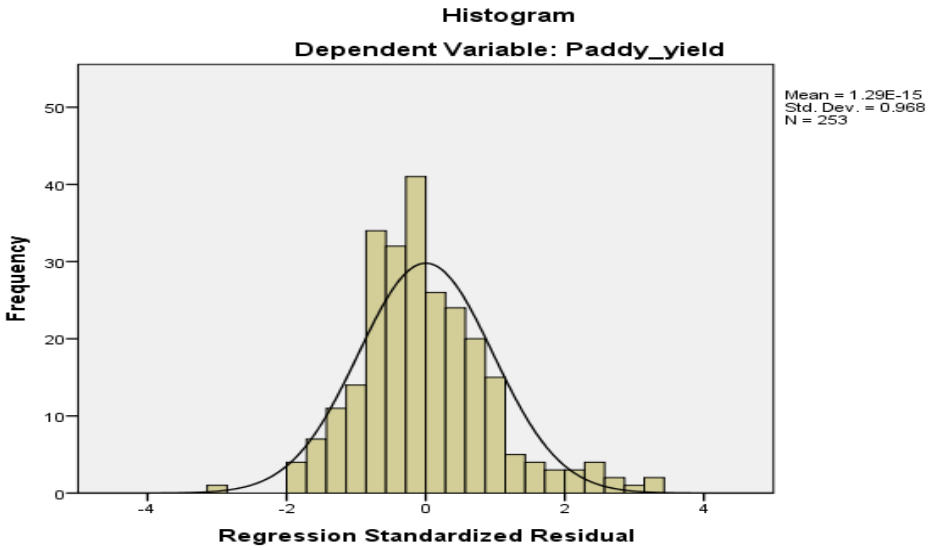
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.583[a]	.339	.295	25.911	1.672

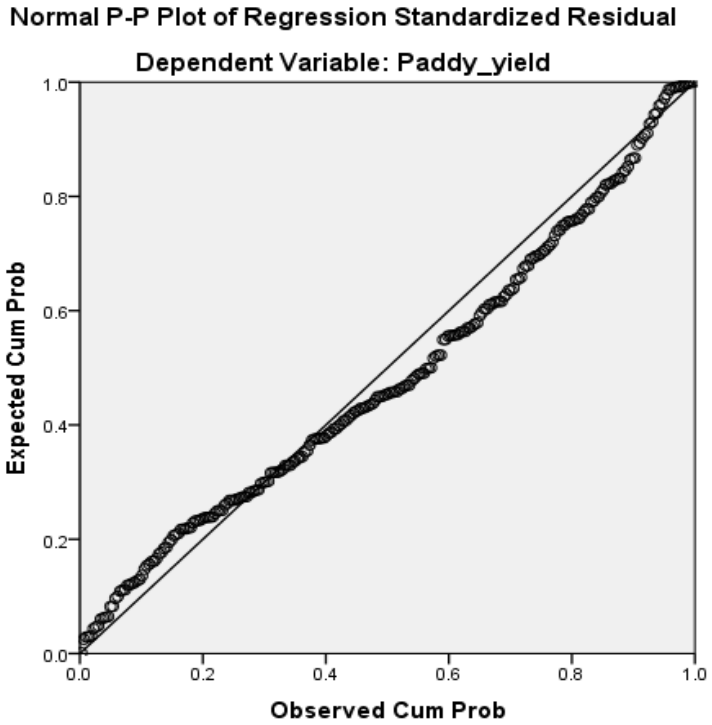
ANOVA[a]

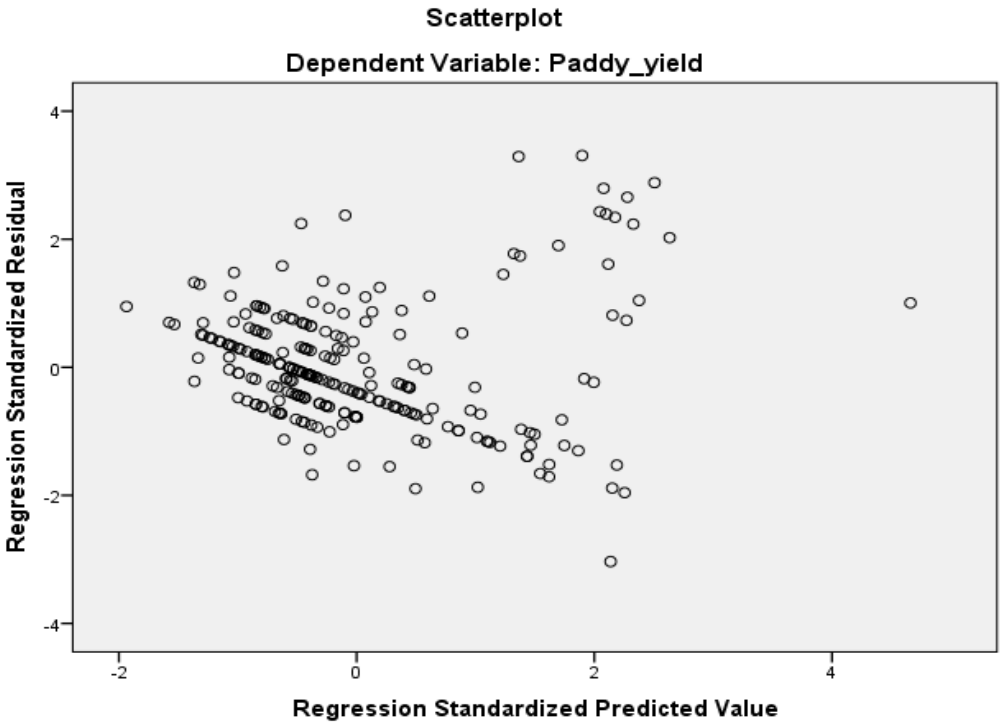
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	81406.451	16	5087.903	7.578	.000[b]
	Residual	158442.024	236	671.365		
	Total	239848.474	252			

a. Dependent Variable: Paddy_yield

b. Predictors: (Constant), River/stream water, Potash, Rain_fed_Irrigation, Irrigation, Rain water, Urea, Rain_fed, Contract_Farming_Practice, Compound, Transplanting, Seeder, Broadcasting, Land_property, Canal water, Wells water, Rock powder


Histogram
Dependent Variable: Paddy_yield
Mean = 1.29E-15
Std. Dev. = 0.968
N = 253
Frequency
Regression Standardized Residual


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Paddy_yield
Expected Cum Prob
Observed Cum Prob


Scatterplot
Dependent Variable: Paddy_yield
Regression Standardized Residual
Regression Standardized Predicted Value
4
2
0
-2
-4
-2
0
2
4

တောင်သူမှတ်တမ်းကောက်ယူခြင်းပုံစံ

စာရင်းကောက်သူအမည် ရက်စွဲ အမှတ်စဉ်

စာရင်းကောက်သူဖုန်းနံပါတ်

တောင်သူအမည်			တောင်သူဖုန်းနံပါတ်
ရွာအမည်			မြို့နယ်
တိုင်း / ပြည်နယ်			
ပုဂ္ဂိုလ်	ကျား ☐	မ ☐	

၁။ ကန်ထရိုက်လယ်ယာ စိုက်ပျိုးရေး လုပ်ကိုင်ခြင်း အတွေ့အကြုံ ရှိ/မရှိ။	ရှိ ☐	မရှိ ☐
၂။ ကန်ထရိုက်လယ်ယာ စိုက်ပျိုးရေး အပေါ် သဘောထား။		
၃။ လုပ်ကိုင်ဘူးပါက မည်သည့် ကုမ္ပဏီနှင့် လုပ်ကိုင်သနည်း။	( )	
၄။ မည်ကဲ့သို့သော သဘောတူညီချက်ဖြင့် လုပ်ကိုင်ခဲ့ဘူးသနည်း။		
၅။စာချုပ်စာတမ်း ရှိ/မရှိ။	ရှိ ☐	မရှိ ☐
၆။ ကန်ထရိုက်လယ်ယာ စိုက်ပျိုးရေး ဆက်လက်ဆောင်ရွက်နေခြင်း ရှိ/မရှိ။	ရှိ ☐	မရှိ ☐
၇။ ရှိလျှင် မည်သည့် ကုမ္ပဏီနှင့် ဆက်လက်လုပ်ဆောင်နေသနည်း။	( )	
၈။ မရှိလျှင် အဘယ့်ကြောင့် ရပ်လိုက်သနည်း။		
၉။ ယခင် တွေ့ကြုံခဲ့ရသည့် အခက်အခဲအား ကုမ္ပဏီမှ ဖြေရှင်းပေးမည်ဆိုပါက ကန်ထရိုက်လယ်ယာ စိုက်ပျိုးရေး ဆက်လက်လုပ်ကိုင်လိုခြင်း ရှိ/မရှိ။	ရှိ ☐	မရှိ ☐
၁၀။ ကန်ထရိုက်လယ်ယာ စိုက်ပျိုးရေးလုပ်ကိုင်ဆိုပါက မည်ကဲ့သို့သော သဘောတူညီချက်ဖြင့် လုပ်ကိုင် လိုသနည်း။		
၁၁။ လုပ်ကိုင်မည်ဆိုပါက တောင်သူ၏ မျှော်မှန်းချက်။		

၁၂။ ယခင် ရရှိခဲ့ဘူးသည့် အထွက်နှုန်း၊ ဈေးနှုန်း။ (ကန်ထရိုက်လယ် စပါး/ ဒေသ စပါး) အစိုစက်ကျဈေးနှုန်း					
ကန်ထရိုက်လယ်ယာ စပါး(မိုး)	အထွက်နှုန်း	(တင်း)		ဈေးနှုန်း	(ကျပ်)
ကန်ထရိုက်လယ်ယာ စပါး(နွေ)	အထွက်နှုန်း	(တင်း)		ဈေးနှုန်း	(ကျပ်)
ဒေသ စပါး (မိုး)	အထွက်နှုန်း	(တင်း)		ဈေးနှုန်း	(ကျပ်)
ဒေသ စပါး (နွေ)	အထွက်နှုန်း	(တင်း)		ဈေးနှုန်း	(ကျပ်)
၁၃။ စပါးဈေးနှုန်း သတ်မှတ်ချက် အပေါ်တွင် ထားရှိသော တောင်သူ၏ သဘောထား နှင့် မျှော်မှန်းချက်။					
၁၄။ အောင်မြင်ခဲ့ခြင်း ရှိ/မရှိ။ (မအောင်မြင်ခဲ့လျှင် တောင်သူ၏ လိုအပ်ချက်/ ကုမ္ပဏီ၏ လိုအပ်ချက်)					
၁၄.၁။ တောင်သူ၏ ဆောင်ရွက်ချက်					
၁၄.၂ကုမ္ပဏီ၏ ဆောင်ရွက်ချက်					
၁၅။ ကန်ထရိုက်လယ်ယာ စိုက်ပျိုးရေး စနစ် လုပ်ကိုင်ရာတွင် ကြုံတွေ့ရသည့် အခက်အခဲများ နှင့် အကြံပြုချက်များ၊					
စပါးအထွက်နှုန်း					
စပါးဈေးနှုန်း					
ရာသီဥတု					
ရေရရှိမှု					
နှံညှးပညာ					
အခြား					
၁၆။ ကန်ထရိုက်လယ်ယာ စိုက်ပျိုးရေး စနစ် လုပ်ကိုင်ရန် နွေစပါး၊ မိုးစပါး မည်သည်ကို ပိုနှစ်သက် သနည်း၊					
နွေစပါး ☐ မိုးစပါး ☐					

တောင်သူမွေတ်တမ်းကောက်ယူခြင်းပုံစံ

၁။	အသက်	၃၀ အောက် ☐	၃၁နှင့်၄၀ကြား ☐	၄၁နှင့်၅၀ကြား ☐	၅၀နှင့်အထက် ☐
၂။	အလုပ်အကိုင်	အဓိကအလုပ်အကိုင်		အခြား	
၃။	မိသားစုဝင်အရေအတွက်	စုစုပေါင်း ____ဦး	ကျား ____ဦး	မ ____ဦး	အခြား ____ဦး
၄။	မိသားစုဝင်အသက်အုပ်ငယ်းအခြား	၁၅နှစ်အောက် ☐			
၅။	(ဦးရေ)	၁၅နှစ်နှင့် ၃၀နှစ်ကြား ☐	၃၁ နှစ်နှင့် ၄၅နှစ်ကြား ☐	၄၆ နှစ်နှင့် ၆၀ နှစ်ကြား ☐	
၆။	လယ်မြေပိုင်ဆိုင်မှု	၁ ကေအောက်	☐ ၁ ကေနှင့် ၂.၅ ကေကြား	☐ ၃ ကေနှင့် ၅ ကေကြား	☐ ၅.၅ကေနှင့် ၁၀ ကေကြား ☐
		၁၀.၅ ကေနှင့် ၂၀ ကေကြား	☐ ၂၀.၅ ကေနှင့် ၄၀ ကေကြား	☐ ၄၀ ကေနှင့်အထက်	
၇။	အမှန်တကယ်စိုက်ပျိုးနေသည့်ကေနှင့်ငှားလယ်မြေအား စီမံခန့်ခွဲခြင်း ကို မည်ကဲ့သို့လုပ်ဆောင်နေသနည်း				
		ကိုယ်တိုင်စိုက် ( ) ကေ	သီးစားချ ( ) ကေ	အငှားချ ( ) ကေ	ယာစိုက်ခင်း ( )ကေ
၈။	ကုန်ပစ္စည်းသယ်ယူနိုင်မည့်ယာဉ်	ထော်လာကျီ ( )စီး	ပုစဉ်ခေါင်း ( )စီး	ဖော်ကား ( ) စီး	( ) စီး
၉။	လယ်ယာသုံးပစ္စည်းဝိုင်ဆိုင်မှု	ထွန်စက် ( )စီး	လက်တွန်းထွန်စက်( )စီး	ရိတ်ချေစက် ( )စီး	
၁၀။	စိုက်ပျိုးသည့်နည်းစနစ်	(၁) သမန်းပြင်စိုက်/အစိုးစိုက်	☐ ပက်ကျဲ	☐ ပျိုးထောင်	☐ Seeder ☐
		(၂) အခြောက်စိုက်(ပက်ကျဲ)	☐ မိုးကောင်းသောက်	☐ မိုးကောင်းသောက်/ ဆည်	☐ မိုးကောင်းသောက်/ ကန်/ကန် ☐
၁၁။	စပါးထားသိုမှု	ဂိုလ်ထောင်	☐ စပါးကျီ	☐ တိုက်ရိုက်ရောင်း	☐ အခြား ☐
၁၂။	ရောင်းချသည့်ပုံစံ	၁ ရက်အတွင်း	☐ ၁ ရက်မှ ၅ ရက်အတွင်း	☐ ၆ ရက်မှ ၁၀ ရက်အတွင်း	☐ ဈေးကောင်းရမှ ☐
၁၃။	တစ်နှစ်ဝင်ငွေ (တစ်ကေအသားတင်အမြတ်ငွေ)		၁.၅ သိန်းအောက်	☐ ၁.၅သိန်းနှင့် ၃သိန်းကြား	☐ ၃.၅ သိန်းနှင့် ၄.၅သိန်းကြား ☐
			၅ သိန်းအထက်	☐	
၁၄။	တောင်သူလုပ်သက်	၂ နှစ်အောက်	☐ ၂ နှစ်နှင့် ၅ နှစ်ကြား	☐ ၆ နှစ်နှင့် ၁၀ နှစ်ကြား	☐ ၁၁ နှစ်နှင့်အထက် ☐
၁၅။	ကြွေးမိုအခြေအနေ	အစိုးရ		သမဝါယမ	
	(ပမာဏရေးထည့်ရန်)	အသေးစားချေးငွေကုမ္ပဏီ		NGO	
၁၆။	စိုက်ပျိုးခဲ့သည့်စပါးမျိုးများ		မျိုး	မျိုး	မျိုး မျိုး
၁၇။	ဓါတ်မြေဩဇာသုံးစွဲမှု(တစ်ကေ)	ကုန်ပေါင်	အိတ် ယူရီယာ	အိတ် ကျောက်မှုန့်	အိတ် ဝိတက်ချ် အိတ်
၁၈။	ကျရောက်တတ်သောပိုးအမျိုးအစား		ပိုး	ပိုး	ပိုး ပိုး
၁၉။	ကျရောက်တတ်သောမိုရောဂါ		ရောဂါ	ရောဂါ	ရောဂါ ရောဂါ
၂၀။	သုံးသပ်ချက်				

တောင်သူမြေမှတ်တမ်းကောက်ယူခြင်းပုံစံ

တောင်သူအမည်		ရွာအမည်	
တိုင်း / ပြည်နယ်		မြို့နယ်	

၁။	စုစုပေါင်းလယ်မြေကေ/ အကွက်	( ) ကေ	အကွက်အရေအတွက် ( )အကွက်	
၂။	မိုးစပါးစိုက်ပျိုးသည့်ကေ( )	နွေစပါးစိုက်ပျိုးသည့်ကေ( )	အခြားစိုက်ပျိုးသည့်ကေ( )	
၃။	တဆက်တစ်စပ်တည်းရှိသော	၂ ကေ၊ အကွက် ☐	၃ ကေ၊ အကွက် ☐	
	မြေကွေနှင့်တည်နေရာ	၄ ကေ၊ အကွက် ☐	၅ ကေ၊ အကွက် ☐	
	(အကွက်အရေအတွက်)	၆ ကေ၊ အကွက် ☐	၇ ကေ၊ အကွက် ☐	
		အခြား		
၄။	လယ်မြေကေအကျယ်အဝန်း	၁ ကေ၊ အကွက် ☐	၀.၅ ကေ၊ အကွက် ☐	
	(အမှန်ချစ်ရန်)	၀.၅ ကေအောက်၊ အကွက် ☐	အဆင့်မြင့်လယ်ယာအကွက် ☐	
၅။	လယ်နီးချင်း မြေပိုင်ဆိုင်သူများအမည်	၁။	၂။	၃။
	(နာမည်များထည့်ရန်)	အရှေ့	အရှေ့	အရှေ့
		အနောက်	အနောက်	အနောက်
		တောင်	တောင်	တောင်
		မြောက်	မြောက်	မြောက်
၆။	ကုန်ထုတ်လမ်းနှင့်နီးစပ်မှု	ကုန်ထုတ်လမ်းဘေး ☐	ကားလမ်းဘေး ☐	ရွာလမ်းဘေး ☐ လယ်ကွက်အပိတ် ☐
		ကုန်ထုတ်လမ်းနှင့် ☐အကွာခြား ☐		ကုန်ထုတ်လမ်းနှင့် ☐အကွာခြား ☐
		ကုန်ထုတ်လမ်းနှင့် ☐အကွာခြား ☐		ကုန်ထုတ်လမ်းနှင့် ☐အကွာခြား ☐
၇။	မြေအမျိုးအစားနှင့် ကေ	ရွံစေးဆန်သောမြေ ☐		သဲဆန်သောမြေ ☐
၈။	ဆန်စက်/အခြောက်ခံစက်မှုအကွာအဝေး	မိုင် ☐	ဖာလုံ ☐	ကိုက် ☐
၉။	ရေရရှိနိုင်မှု	ဆည်ရေရရှိနိုင်ခြင်း ☐	တူးမြောင်းမှရေရရှိနိုင်ခြင်း ☐	အဝီစီရေရရှိနိုင်ခြင်း ☐ မိုးရေသာရရှိနိုင်ခြင်း ☐
		ကန်ရေရရှိနိုင်ခြင်း ☐	မြစ်ချောင်းမှရေရရှိနိုင်ခြင်း ☐	☐ ☐
၁၀။	လယ်ကွက်အခြေအနေ	ရေသွင်းရေထုတ်ကောင်းမွန်ခြင်း ( ) အကွက်	ရေဝပ်ခြင်း ( )အကွက်	
	(အရေအတွက်)	ရေနက်ကွင်း ( )အကွက်	ရိုးကွက် ( ) အကွက်	ကုန်းကွက် ( )အကွက်
၁၁။	သုံးသပ်ချက်			