

**YANGON UNIVERSITY OF ECONOMICS**  
**DEPARTMENT OF ECONOMICS**  
**MASTER OF ECONOMICS**

**A STUDY OF THE RICE PRODUCTION SUPPLY CHAIN  
IN PHYAPON TOWNSHIP, AYEYARWADDY REGION**

**PHYO KHANT KYAW**

**SEPTEMBER, 2023**

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**A STUDY OF THE RICE PRODUCTION SUPPLY CHAIN IN  
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A thesis submitted in partial fulfillment of the requirements for the  
Master of Economics (M.Econ) Degree

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**YANGON UNIVERSITY OF ECONOMICS**  
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This is to certify that this thesis entitled "**A Study of the Rice Production Supply Chain in Phyapon Township, Ayeyarwady Region**" submitted as a partial fulfillment towards the requirements for the degree of Master of Economics has been accepted by the Board of Examiners.

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## **ABSTRACT**

The study examines the process of the supply chain of rice production in Phyapon Township. This study used a descriptive and multiple regression method. Results due to challenges are faced by farmers, suppliers, millers, retailers, and customers in the supply chain of rice production. Farmers need to be promoted by the government and non-government organizations to support access to finance. Moreover, in the influencing factor analysis, rice yield was positively and significantly influenced by labor, access to finance, and material costs. Rice yield was positively and significantly influenced by labor and negatively influenced by material cost. The government's support for the transportation of farmers can be reduced by transportation costs. Farmers faced with the need for workers and government supply to support the employment of workers can chain in these areas, which promotes rice production. Therefore, the government needs to support these regions by promoting labor and access to financing. The government's support to promote transportation in rice production reduces material costs and can increase the output of rice production.

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## **LIST OF ABBREVIATIONS**

(EU) plan	Recovery plan for Europe
AGSCM	Agricultural Green Supply Chain Management
ASCM	Agricultural Supply Chain Management
BCR	Benefit Cost Ratio
DEA	Data Envelopment Analysis
GAP	Good Agricultural Practices
GSCM	Green Supply Chain Management
INGOs	International Non-Government Organization
MADB	Myanmar Agricultural Development Bank
MOAI	Ministry of Agriculture and Irrigation
NGOs	Non-Government Organizations
Non-GMO	Non-Genetically Modified
RSCs	Restaurant Supply Chain Solutions
SDGs	Sustainable Development Goals
SFSCs	Short Food Supply Chains
UNDP	United Nations Development Program

# **CHAPTER I**

## **INTRODUCTION**

### **1.1 Rationale of the Study**

Myanmar's rice production supply chain begins with rice cultivation. The country has a favorable climate for rice cultivation and abundant water resources, making it suitable for both rain-fed and irrigated rice farming. Smallholder farmers who either own or rent small land parcels carry out the majority of rice growing in Myanmar. They engage in traditional farming methods, although some areas have adopted modern agricultural practices.

Myanmar produces a range of rice varieties, including the well-known Ayeyarwaddy Pawsan (fragrant) rice, along with other local kinds and glutinous rice. The harvesting of rice is usually done by hand or with basic tools, and the timing of the harvest is determined by the type of rice and the climate of the area. To extract the edible grains and remove the outer husk, rice is milled and processed after harvest. This procedure is frequently carried out in rural small-scale rice mills.

Once the rice is processed, it enters the distribution stage, where wholesalers and traders play a crucial role. They purchase rice from local millers and farmers and then transport it to various markets or larger trading centers. Myanmar is a significant exporter of rice, and its rice is sold in both international and domestic markets. The country exports rice to various countries, including neighboring Asian nations and Africa. While Myanmar's rice production supply chain was robust, it faced several challenges, including limited access to modern agricultural technologies, infrastructure constraints, and issues related to market access and fair pricing for farmers.

The Ayeyarwaddy Region, located in the southern part of Myanmar, is one of the major rice-producing areas in the country. Rice is the staple food of Myanmar, and

Ayeyarwaddy is known for its fertile delta, which is conducive to rice cultivation. The process starts with farmers who cultivate rice in the fertile lands of Ayeyarwaddy. They prepare the fields, plant the seeds, and manage the crop until it's ready for harvest. Rice is usually grown in both rain-fed and irrigated fields.

Ayeyarwaddy has an extensive network of rivers, creeks, and canals, which are used to supply water to the rice paddies. Irrigation is a critical component to ensure adequate water supply for rice cultivation throughout the year. Once the rice plants reach maturity, farmers harvest the rice grains. Depending on the scale of cultivation and the equipment available, this process can be done manually or using modern machinery.

After harvesting, the rice grains need to be separated from the chaff (husks and stems). Traditional methods involve using cattle or manual labor to thresh the rice. However, mechanized threshers and mills are becoming more common to increase efficiency. The harvested rice is transported to processing facilities where it undergoes further cleaning, grading, and polishing. The rice is then packaged into bags or sacks for distribution and sale.

In the supply chain, distributors and wholesalers are essential players. They purchase large quantities of rice from processing facilities and transport it to various markets, both within the region and beyond. Rice is sold to consumers through various retail channels, including local markets, grocery stores, and supermarkets. In rural areas, small local shops are common, while larger urban centers have more extensive distribution networks.

Myanmar is a major exporter of rice, and Ayeyarwaddy Region contributes significantly to the country's export volumes. Rice may be shipped from Myanmar's ports to international buyers, making it an essential part of the region's economy. Therefore, the rice production supply chain can be influenced by various factors, including government policies, weather conditions, infrastructure development, and global market demands. Political and economic changes that might have occurred since rice production may also have impacted the supply chain in the Ayeyarwaddy Region.

Pyapon Township stand within the south-central Ayeyarwaddy region and borders the Andaman Islands on the west and south. Bogale Township is bordered by its concave northwest border. To the northeast, it borders the Kyaiklat and Dedaye Townships of Pyapon region. The urban has 23 wards total and is composed of 212 villages, fifty-two village tracts, and 2 cities.

Phyapon's rice supply chain is influenced by a number of variables, including its agricultural potential. Rice farming is made possible by the lush land and temperate climate of Phyapon. The topography and soil characteristics of the area are favorable for rice cultivation, fostering a prosperous agricultural industry. Rice has long been a primary crop in Myanmar, and the region of Phyapon is renowned for its traditional rice farming methods. Through the decades, the local farmers have acquired expertise and understanding in rice farming practices. The region's total rice production efficiency and the availability of competent farmers are both influenced by this legacy.

The low agricultural income is seasonal due to the insufficiency of off-season crops, which causes many young individuals to relocate to metropolitan regions when they lose their jobs after the harvest. The salinity has been rising in the municipality ever since Cyclone Nargis made landfall in Phyapon and increased coastal flooding. Salinity problems were affecting 85% of the township's fields, and farm outputs were dropping. Nowadays, conventional farming methods are useless, and agricultural technology is continually developing.

Therefore, this study has to identify the supply chain of rice production and the different challenges of the process. More specifically, this study will focus on the stakeholders faced by the challenges of rice production in the supply chain.

## **1.2 Objectives of the Study**

The main objective is to study the process of supply chain on rice production in Phyapon Township.

The specific objectives of the study are;

- (1) To examine the various stages involved conditions in producing, processing, and distributing rice production from the farm to the end consumers within Phyapon Township
- (2) To analyze the challenges faced by the actors involved in the supply chain of rice production in Phyapon Township

## **1.3 Method of Study**

This study used a descriptive method based on both primary and secondary data. Primary data were collected through personal interviews and questionnaires administered through field surveys during August 2023. By using quantitative

approaches, 273 respondents were selected from Phyapon township, Ayeyarwaddy region.

Secondary data were collected from publications, reports, the internet, and the township administrative office and previous studies.

#### **1.4 Scope of Limitations of the Study**

This survey was conducted on 273 households in the targeted region. This households have involved farmers 70 households, suppliers 65 households, millers 8 households, retailers 65 households, consumers 65 households. The survey focused on the targeted five villages (Koeaintan, Kani, Thamainhtaw, Zine Maung and Kyanetha (Shn Kwin) and other stakeholders in the in Phyapon Township. The study period is from June to September 2023. The household survey was conducted using a questionnaire distributed to the selected stakeholders. The questionnaire survey is interviewed various stakeholders such as; farmers, suppliers, millers, retailers, and customers) in Phyapon Township, Ayeyarwaddy Region.

#### **1.5 Organization of the Study**

There are five chapters in this study. The first chapter of the study organizes the introduction, rationale, objectives, method, scope, and limitations. Chapter two is a literature review. Chapter three states the background information on rice production in Phyapon Township. Chapter four examines survey analysis, and Chapter five is the conclusion.





## **CHAPTER II**

### **LITERATURE REVIEW**

#### **2.1 Definition and Concept of Supply Chain**

All parties involved in directly or indirectly completing a consumer request are included in a supply chain. Along with suppliers and producers, the supply chain also consists of carriers, storage facilities, retailers, and even the actual customers. The supply chain in every business, such as a producer, entails all activities involved in receiving and finishing a client request. New product creation, marketing, operations, distribution, financing, and customer support are just a few of these activities.

A supply chain is dynamic and involves a continuous flow of facts, merchandise, and money between several phases. The phrase "supply chain" conjures up pictures of goods or supplies going up a chain, from manufacturers to wholesalers to retailers to customers. This is a component of the supply chain, but it's crucial to understand how information, money, and products flow in both directions throughout this network. The phrase "supply chain" could mean that there is only one participant at each stage. In practice, a producer might get materials from many vendors before supplying them to various distributors.

A typical supply chain could include several phases. Customers, retailers, wholesalers/distributors, manufacturers, and suppliers of components and raw materials are among the supply chain's several nodes. A supply chain's various stages are linked through the movement of goods, facts, and money. These flows frequently go both ways and may be controlled by a stage or an intermediary.

Every supply chain should aim to maximize the value that is created overall. The value a supply chain creates is the difference between the price the customer pays for the finished product and the expenses the supply chain incurred to fulfill the customer's request. Value will be closely connected with supply network profit (also referred to as supply chain surplus) for the majority of commercial supply chains, which is the difference between customer revenue and the total cost of the supply chain. Supply chain profitability or surplus is the total profit to be shared across all supply chain stages

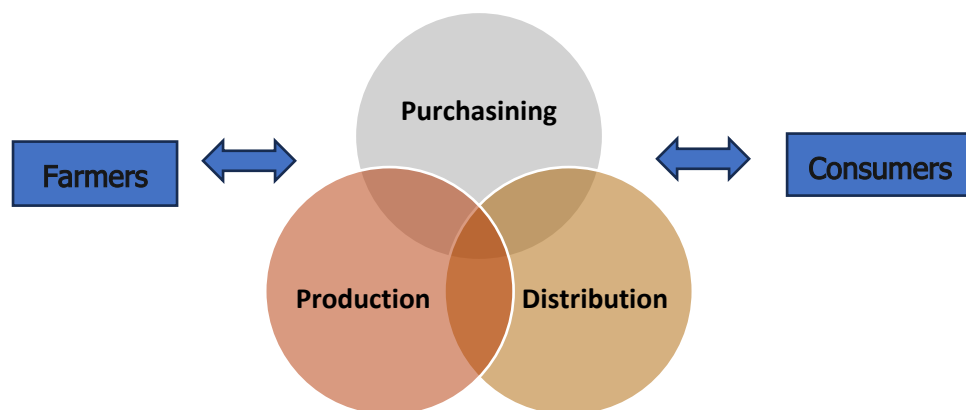
and intermediaries. The higher the supply chain profitability, the more successful is the supply chain. Supply chain success should be measured in terms of supply chain profitability and not in terms of profits at an individual stage.

The alignment of businesses that deliver goods or services to market is how the term "supply chain" is most commonly used in the literature (Smith, C. D., & Zacharia, Z. G,2001). Manufacturers, suppliers, carriers, warehouses, wholesalers, retailers, other intermediaries, and even the customers themselves are all part of the supply chain. Any product traded on the consumer goods market goes through many subsequent transactions on the business-to-business market as it develops from raw material to completed goods."

All parties involved in directly or indirectly completing a customer request are included in a supply chain (Baharun, R., & Yusoff, R. M,2012). The supply chain encompasses all activities involved in receiving and meeting a customer request within each organization, such as a manufacturer. These duties comprise but are not limited to, those related to the creation of new products, marketing, operations, distribution, finance, and customer service.

A typical supply chain is a web of processing links for commodities, data, and services that demonstrates the characteristics of supply, transformation, and demand, Chen and Paulraj (2004). The three conventional supply chain stages of production, distribution, and purchase are shown in Figure (2.1). Each of these steps might consist of several facilities spread out across the globe (Thomas and Griffin, 1996).

**Figure (2.1) Three Traditional Stages in the Supply Chain**



Source: Thomas and Griffin, 1996

A supply chain is a "Life cycle process comprising physical, information, financial, and knowledge flows whose purpose is to satisfy end-user requirements with

products and services from multiple linked suppliers". According to this definition, the supply chain encompasses processes that cover a broad range of activities including sourcing, manufacturing, transporting, and selling physical products and services. Life cycle refers to both the market life cycle and the usage life cycle and these are not the same for durable goods and services. Therefore, product support after the sale becomes an important supply chain component (Pettersson, A. I., & Segerstedt, A.,2013).

The three interrelated flows that make up a complete supply chain system are typically buying goods transformation, and transport of materials, electronic data exchange for information, and financial flows, which cover payments made to contractors and suppliers for the goods and services as well as payments made by customers to retailers for the finished product Felea, M., & Albăstroi, I. (2013). Physical distribution is a crucial component of supply networks, and in many supply chains, information and financial elements are equally crucial to the movement of goods. We also need to emphasize the importance of knowledge inputs in supply chain operations. For instance, the supply chain process for new products necessitates close coordination between physical inputs (components, prototypes, etc.) and intellectual inputs (the design).

In the supply chain, the flow does not always go from the first supplier to the last customer. For a variety of reasons, including service or repair, remanufacturing, recycling, or disposal, goods may move back up the supply chain. In areas like consumer happiness, recycling, and environmental protection, the reverse chain can be crucial. Managing product returns, recycling, reusing materials, waste disposal, refurbishing, or remanufacturing are just a few examples of the related activities that can be included in reverse logistics, which is a set of programs or competencies aimed at moving products in the supply chain's reverse direction (that is, from consumer to producer) Felea, M., & Albăstroi, I. (2013).

Harvesting, and transportation decisions of the sugar supply chain in Australia. Since the Australian sugar industry suffers from financial problems, the proposed model aims to minimize total costs (Teimoury, E., & Barzinpour, F, 2020). The ideal harvest date was determined using a quality loss function, and a genuine case study was provided in this research. When distribution centers were subject to sporadic interruption, one or more of them might at any given time be unable to offer service, this presented a problem for supply chain design. reducing sales, shipping, and inventory expenses is the main goal. The Infield logistics challenge was formulated as

a vehicle routing integer linear programming problem. To harvest crops, the vehicle operations are completed. (Ali et al. (2009).

A mathematical model for rice inventory planning and transportation from farms to milling centers, and from milling centers to export and wholesale ports. The results are obtained using a meta-heuristic algorithm (R., & Phannikul, T, 2017). The shortcomings of Bangladesh's shady rice milling sector. They also looked at the advantages of developing concentrated and focused industrial zones. Clustering can result in the development of these centralized industrial regions. A model of a fresh produce decision support system is used to organize and coordinate the supply chain at the strategic, tactical, and operational levels. The goal is to increase profit. (González-Araya, M. C., & Pla-Aragones, L. M, 2016).

## **2.2 Utilization of Supply Chain Analysis in Agriculture**

Farmers are encouraging direct sales to customers to lessen their reliance on retail and opaque supply networks. Public agencies and advocacy groups take the lead in assisting and innovating agricultural and food industries toward more sustainable practices. Businesses in the retail, food service, or intermediate wholesale sectors, work to expand the availability of regional foods or source more locally.

Non-Government Organizations (NGOs) and concerned citizens seek to more actively advance their interests in the food supply chain. Through cutting-edge models capable of enhancing local economic sustainability and social cohesion, the (EU) plan seeks to promote the reorganization and localization of food systems. The amount of product value maintained by the farmers has decreased as a result of the division between consumer and producer, and the addition of several levels of intermediary. On the other hand, growing consumer interest in food transparency and recognized concerns contribute to a degree of readiness to pay more for locally produced goods, with a large premium going to the farmers.

Food supply chains are undergoing a reinvention process. The unanticipated COVID-19 pandemic, the recent war conflict in Ukraine, and the (SDGs) have caused consumer behavior to alter and further strained conventional food supply chains. Although the COVID-19 pandemic presented unprecedented problems for food systems, consumers, business managers, and researchers, continue to focus on increasing food supply chains' resilience to deal with sources of unexpected instability. These days, food products are approached from a more endogenous, territorialized,

ethical, and environmentally concerned (SFSCs). These channels are regarded as the most suitable for local, small-scale, and organic production families. Food is also re-socialized and re-spatialized in SFSCs. Local cuisine may be a manifestation of cultural capital and rural embeddedness, and serve as an engine for territorial development in both rural and peri-urban communities.

Remote and isolated communities, especially islands, face various problems related to the supply of goods, both from the production and the consumer side. In particular, food supply chains are of major importance for such areas since they are responsible for the well-being of populations; but they are also connected with other important industries, such as tourism. SFSCs are the de facto solution to various problems that these communities face. In some cases, there is no alternative for both producers and consumers (residents).

Thus, in this case, it is important to enhance the relationship among stakeholders so that it is based on mutual trust and understanding of what they can want, and will do. Comprehending that they have to collaborate in building win-win relationships is crucial even for the existence of such communities, given the scarcity of resources. As a result, studying sustainability in distant and isolated regions necessitates multifaceted, holistic approaches because their built and natural environments should be viewed as dynamic ecosystems, taking into account the various stakeholder types that interact in these domains.

According to this line of thinking, a "place-based" multi-layered approach to stakeholder analysis has been suggested, enriching human activities and the well-being of remote communities with a variety of factors, including the natural environment, crucial infrastructure, regulatory framework, remoteness, connectivity, cohesiveness, equity, and eco-efficiency, as well as stakeholders' multiple identities.

The detrimental effects of the rice-producing industry on the livelihoods and financial security of smallholder farmers are largely unknown. Smallholders face particular difficulties on their way to sustainability unless they establish large-scale cooperative cooperation and receive funding from the local government. If environmental standards are raised and policy initiatives focused on the larger social effects of land growth are beneficial to a large number of smaller-scale minor-holder farmers, this shift is conceivable. Additionally, while producing palm oil and related products, significant economic and environmental problems including deforestation, changes in the climate, and smallholder livelihood hurdles arise.

The main cause of these issues has been the large variety of actors participating in its numerous layers. The productivity of smallholders has increased dramatically as a result of the modernization of agricultural practices. However, the per capita output of these small proprietors is lower, and poverty is a common occurrence. However, the other rural employment sources, which are based on equity in land distribution and off-farm profit-making, appear to offer promising results.

Farmers should have access to markets in urban areas and abroad where demand is stronger and where consumers may be willing to pay more for higher-quality and more diverse products. The livelihoods of farmers typically improve with increased market control. Smallholders are extremely likely to be able to trade off their concern of unfavorable contract conditions that lack equity to access better farm inputs and mainstream markets. Without it, achieving local markets will be challenging since sustainable rice production will continue to be an unattainable aim. Despite this, market potential has led to challenging labor, financial, and environmental needs as well as trade-offs between agricultural expansion and livelihood security. This enables community farming to tackle certain systemic obstacles through ingenuity, entrepreneurship, and renegotiation of the oil palm contract farming.

Good market governance is a significant task for the majority of small-scale agricultural producers in developing nations who frequently face high risk and have limited access to the market. Contract farming, however, can aid the situation and ease market access constraints in some circumstances, although standard marketing agreements do not in that situation. Additionally, certification is crucial in this context since it enhances sustainability and small farmers' integration into global value chains that can have positive socioeconomic effects. Consumer satisfaction with the effective overall production of smallholders is increased by regular market performance analyses.

Green supply chain management (GSCM) is always known as the environmental supply chain based on green manufacturing theory, which was first introduced by the Manufacturing Research Society of Michigan State University. Because it is a crucially important management system involving suppliers, production plants, distributors, and customers, to minimize the adverse effects and maximize the efficiency of resource utilization through the improvement of the entire implementation incorporating environmental concepts, the businesses, merchants, and farmers within

the supply chain can benefit from GSCM and use it as a valuable resource to improve their environmental performance, Wang, M., & Zhang, K. (2022).

One of the sectors most impacted by the climate is agriculture. Agriculture production and climate change are related, and this link is complex and particular to developing nations. In addition, as compared to conventional supply chains, agricultural products have several unique characteristics that make (ASCM) more challenging because of considerations related to seasonality, environment, and perishability. The 'green' idea merges environmental and ecological considerations to maintain environmental sustainability, which has a substantial impact on the environment including pollution, emissions, health risks to humans, etc. As a result, (AGSCM) has emerged as a crucial branch of sustainable operations management that requires increased attention. AGSCM actively contributes to enhancing environmental performance and economic stability as more and more environmental rules are established.

Barriers, meanwhile, are things that prevent AGSCM from being implemented. Cost and risk, a lack of government backing, financial restrictions, a lack of commitment from suppliers, a need for credibility, technological advances, and resistance are some of the significant challenges. The three essential elements of AGSCM—environment, strategy, and logistics—involve proactive actions including reusing, reprocessing, and tracking environmental requirements. Green criteria must be met by the product, the package, and the purchase as a way to enhance sustainability. To reduce harmful environmental effects, all supply chain actors must take the initiative and cooperate. from the stakeholders.

## **2.2.1 Marketing Channel and Marketing Cost and Margin of Rice Production**

### **(a) Marketing Channel**

There are many marketing channels involved in the marketing of paddy/rice. The following are the criteria for the selection of efficient marketing channels. The channel, which ensures a reasonable return to the producer, is considered to be good or efficient. Cost of transportation through the route. The market margins and commission fees that middlemen like traders, commission agents, wholesalers, and retailers receive. It is best to choose the shorter channel with the lowest market cost.

The large-scale and median-scale mills mainly provide milling services for farmers, traders, and some collectors. Additionally, they also buy paddy from farmers

and collectors, process it, and sell rice to wholesalers and traders. The small-scale plants, which are numerous in numbers, are widely spread in the rice-producing area. Generally, almost all of them are privately owned and mainly process paddy from their farm and for the neighborhood farmers for their own consumption needs.

The primary middlemen are local wholesalers, who often conduct their business on a huge scale. Wholesalers routinely inform other wholesalers, millers, and retailers of their buying and selling prices. As a result, wholesalers are crucial to the local community's dissemination of information about rice prices. However, local wholesalers are disappearing as a result of millers' increased market strength as they concurrently grind and trade rice.

Retailers are the last or final intermediaries in the marketing channel through which rice reaches the consumers. They are reported on buying rice from local wholesalers or millers and transporting it to their shop by trishaw or a rental car. There is no price negotiation between the retailer and wholesaler or miller to supply rice, the retailer usually buys rice at market price and sets the selling price depending on the buying rice price and their expected market margin.

Agencies include producers and middlemen (merchant middlemen: wholesalers, retailers, commission agents, speculative middlemen; processors (miller) and facilitative middlemen; weighmen, graders, and transport agencies).

## **(b) Marketing Costs and Margins**

The actual expenditures incurred in getting products and services from the producer to the consumer are referred to as marketing costs. The handling fees by wholesalers and retailers, assembly fees, transport and storage costs, handling fees, expenses on secondary services like finance, risk-taking, and market intelligence, and profit margins collected by various agencies are among the typical marketing costs.

Margin is the difference in the price that a particular selling agency, for instance, a single retailer, pays and receives. It can also refer to any sort of advertising agency, such as retailers or wholesalers, or any combination of advertising agencies within the marketing system overall.

The services of various agencies constituting a marketing channel are remunerated out of the marketing "margin". This term used in this study is the difference between the price paid to the first seller and that paid by the final buyer. Marketing cost and marketing margin are calculated for some main agents such as



collectors, small, medium, and large-scale millers, local wholesalers, and retailers in the rice marketing channel. Because of the lack of capital and paddy and rice price fluctuation, collectors in this study serve as the agents for the millers. Therefore, the marketing margin of the collectors is the commission fees for buying paddy.

The commodity types handled by the middlemen are different in the rice marketing channel as paddy in collectors and millers and rice in others. The percentage of profit per cost price indicator (return on investment) is used in this study to compare their achievement in the marketing channel. Some millers provide milling service only for farmers and traders while most millers purchase paddy either directly from farmers and collectors. The processing and selling business of millers could receive a higher net margin than that of other intermediaries. The percentage of profit per cost price is also high in the millers. Surprisingly, small-scale millers outperform medium-scale millers in terms of profit. Large-scale millers achieve the most profit per cost price.

Transportation facilities at the producer level involve training of producers, malpractices in markets, financial problems, infrastructure facilities, and superfluous middlemen. The main rice marketing channels indicate that almost all products of farmers flow to collectors and millers. Besides, marketing margin analysis also draws attention to the increasing market power of millers with high profit per investment. Due to the absence of formal cooperative structures, the existence of farmers' advocacy groups, and the growing market dominance of millers at the farm gate, farmers have little negotiating strength when trading paddy and rice.

The informal trading networks also share market information among the network and personal contacts are the main source of information. Therefore, the available information is not always systematic and reliable due to the variety of sources of market information. To solve the errors that arise from conflicting sources of information a public market information center organized by the government and non-profit rice traders' organizations to distribute reliable up-to-date market information effectively and efficiently.

Small land-holding farmers in villages produce enough rice amounting to a year's stock for their use. In most cases, the village miller will mill the farmer's small amount of paddy rice free of cost in exchange for rice bran. Given the small working capital and capacity of the mill, this is a relatively small business. The produce from other farmers' medium-sized farms is sold straight to the neighborhood mills. Farmers are compelled to sell their crops to paddy collection or dealers at the asking rate if

getting to mills is restricted due to bad road conditions or expensive transportation expenses. The paddy is subsequently sold by the paddy collectors for a profit to either the millers or the export market.

Fair-trade initiatives have stepped in to help farmers in many nations connect with customers prepared to pay a premium to cover the expenses of both production and investment. Small-scale farmers' livelihoods have been improved because of these programs. Large landowner farmers frequently deliver their paddy rice straight to mills that process it, cutting out the intermediaries and maximizing their profit. Companies that process rice also find it economical to buy directly from farmers because doing so lowers expenses associated with shipping, supply-chain intermediaries, and procurement.

The trends in the rice supply chain are, however, changing, with the small farmers selling more of their cultivated rice for increasingly better prices. This is being made possible through government schemes assisting farmers, an increase in contract farming that stimulates consolidation of grain production, the implementation of the farm-to-fork concept in emerging corporate farms, and better traceability and control of operations built into the rice supply chain. The ties within the supply chain that carry rice into end users, or the forward linkages, are projected to grow improve, and be more organized within the selling and marketing processes, which will consolidate the amount of rice traded. There is better control and influence to help farmers and offer consumers a low-cost purchasing option in nations where the government subsidizes the production of rice.

### **2.2.2 Importance of Consumer Buying and Consumption Preferences of Supply Chain**

Supply Chain Management (SCM) itself requires very well-connected inter-organizational relationships between supply chain partners to have a better supply chain to achieve customer satisfaction and ultimately competitive advantage. Supply chain collaboration between partners is vital for the inter-organizational relationship of focal firms nowadays. Trust-based and longtime relationships with suppliers have many benefits for focal firms to achieve better supply chain performance on the customer side of the chain.

Even managers of the organizations are ultimately held accountable for the performance of their organizations, the success of their organizations also depends

heavily upon the success of the supply chain in which the organization participates as a partner. Success in this supply chain is mostly defined as customer satisfaction. Today's managers must manage both successfully and efficiently at the organizational level as well as at the level of the supply chain to achieve the highest degree of customer satisfaction. According to a new supply chain strategy, the ability to establish long-term, strategic partnerships with supply chain partners is a prerequisite for effective SCM. In terms of both satisfaction with the goods and/or services and a relatively low overall cost of the goods and/or services, such successful SCM optimizes value to the supply chain's final customers.

Supply chain performance is two-dimensional, consisting of effectiveness and efficiency. Simply put, efficiency is doing things right and effectiveness is doing the right things. Supply chain effectiveness is measured in terms of consumer satisfaction (Zokaei and Simons, 2006). Supply chain efficiency, however, relates to the performance of the individual processes; it is the reciprocal of the resources absorbed by the supply chain. The effectiveness can be improved through enhancement of the value proposition; for instance, new features could be added to a product to fulfill an unmet consumer need or a supply chain setup could be altered to deliver the exact requirements of the final consumer. The basic instances of supply chain ineffectiveness are the activities that are unnecessary from the consumer's point of view or duplicated. More subtle effectiveness improvements relate to situations where the value chain exceeds the expectations of the end-user. A tool for improvement of supply chain effectiveness deployed in a commodity sector.

The customer is a crucial link in the supply chain, and the choices purchasers make regarding suppliers will be influenced by their wants, values, and opinions. Since no supply network is impervious to disruption, firms are under pressure to protect their supply chains. Businesses must therefore gain a clear grasp of what qualities customers value in them and how they set themselves apart from competitors. You may segment the risks that might negatively affect how the supply chain contributes to your key customer value proposition and develop resilience skills to manage big risks if you keep this in mind. It is possible to take control of risk and build a more resilient supply chain focused on defending client interests by implementing effective supplier management.

The most susceptible causal elements for supply chain management are product quality, price, green awareness, and environmental law, and they require more attention. Consumers have two worries that never go away: cost and quality of products.

One of the key instruments used by marketers to establish their positions in the market is product quality, which has two elements: level and consistency. The ability of an agricultural product to fulfill its purpose, including its nutritive value, flavor, safety, and other characteristics, is referred to as its quality.

The quantity of goods that consumers are able and willing to purchase at any given price is known as consumer demand. While the latter is controlled by the consumer's intent to buy and actual income level, the former is affected by the quantity of the good demanded, its price, and the price of a substitute good. Therefore, it can be said that the amount of consumer demand is determined by the price of the agricultural product. In addition to requiring the incorporation of green innovation for altering product green operation, cost control, and customer satisfaction, shareholders' needs are closely related to activities of green products and processes in agriculture supply chain management.

Government subsidies can increase the effectiveness of all green agricultural production, encouraging partners in the agricultural supply chain to use green technology and provide green agricultural products. Furthermore, since government subsidies can offset part of the costs incurred by manufacturers of green products, these manufacturers can charge less for their green items. Government subsidies for green agricultural products benefit society as a whole because they boost consumers' willingness to pay for environmentally friendly consumption and the amount of surplus, they can get from doing so. Monitoring refers to the management of political, economic, and social public affairs by the relevant departments, which can supervise and manage the behavior of the subjects at all levels in the green agricultural supply chain through laws and regulations. Monitoring is not only conducive to maintaining fair development rules but also can create a harmonious and stable social environment, thus making the green supply chain develop in a better and healthier way.

As a result, all stakeholders in agriculture supply chain management can examine each influencing factor and the causes that support it, or they can use a cause-and-effect diagram to pinpoint the causal relationships between each influencing factor.

### **2.3 Measurement of Supply Chain in Rice Production**

The supply chain in rice production is measured by rice production quantity, socioeconomic factors, input costs, agricultural practices, technological advancements,

market demand, infrastructure, environmental factors, government policies, and global factors Van Nguyen, N., & Ferrero, A. (2006).

**Rice Production Quantity:** The total amount of rice produced within a specific time frame. This can be measured in metric tons or any other relevant unit.

**Socioeconomic Factors:** The socio-economic conditions of the regions where rice is produced can influence production levels. Factors like income levels, population growth, and land distribution can all have an impact.

**Input Costs:** The cost and availability of inputs such as seeds, labor, machinery, and fertilizers can affect the level of rice production.

**Agricultural Practices:** Factors related to farming techniques, irrigation methods, use of fertilizers, and pest control can influence rice production efficiency and output.

**Technological Advancements:** Innovations in agricultural technology can lead to increased productivity and efficiency in rice production.

**Market Demand:** The demand for rice in the market can drive production levels. If there's a higher demand for rice, producers might increase their output to meet it.

**Infrastructure:** Adequate transportation, storage facilities, and access to markets play a crucial role in the rice supply chain.

**Environmental Factors:** Variables like weather conditions, climate patterns, and natural disasters can significantly impact rice production. For example, droughts, floods, or extreme temperatures can affect crop yields.

**Government Policies:** Government regulations, subsidies, trade policies, and import/export restrictions can have a significant impact on rice production.

**Global Factors:** Changes in the global rice market, international trade policies, and geopolitical events can also affect the rice supply chain.

Among these factors, rice production quantity, socioeconomic factors, input costs, agricultural practices, technological advancements, market demand, Infrastructure, and environmental factors are examined in this study.

Challenges faced by stakeholders in the supply chain of rice production can be diverse and multifaceted. These challenges can encompass various stages of the supply chain, from cultivation and harvesting to processing, distribution, and retail. Stakeholders in the rice production supply chain include farmers, processors, distributors, retailers, policymakers, and consumers.

Rice production is a critical component of global food security and livelihoods for millions of farmers. However, the rice supply chain faces several challenges that directly impact the farmers involved. These challenges can vary based on geographic location, local context, and socio-economic factors.

### **2.3.1 Opportunities and Challenges Faced by Farmers in the Rice Production Supply Chain**

Some opportunities and challenges of farmers include:

#### **Opportunities:**

1. **Technological Advancements:** The agriculture sector has seen advancements in technology, including precision farming, drones, and IoT devices, which can help farmers optimize their rice production processes.
2. **Market Access:** Improved transportation and communication networks have opened up new markets for rice farmers, allowing them to reach consumers more efficiently.
3. **Value-Added Products:** Diversification into value-added products like organic rice, specialty rice varieties, and rice-based processed foods can lead to higher profits for farmers.
4. **Sustainable Practices:** Growing consumer demand for sustainably produced rice presents an opportunity for farmers to adopt environmentally friendly farming practices.
5. **Government Support:** Government policies, subsidies, and financial assistance can provide support to rice farmers, enhancing their production capabilities and market access.
6. **Global Trade:** International trade allows farmers to access international markets, potentially increasing their profits.
7. **E-Commerce and Direct-to-Consumer Sales:** The rise of e-commerce and digital platforms provides sellers with opportunities to reach consumers directly, bypassing traditional distribution channels. This can lead to increased profit margins and a closer connection with end-users.
8. **Increasing Demand:** The growing global population and changing dietary habits in emerging economies create an increasing demand for rice, offering farmers the opportunity to expand production and increase income.

#### **Challenges:**

1. **Climate Change:** Erratic weather patterns, droughts, floods, and heatwaves can negatively impact rice yields and quality.
2. **Land Degradation:** Soil erosion, nutrient depletion, and loss of arable land can hinder sustainable rice production.
3. **Labor Shortages:** Many regions face difficulties in finding and retaining skilled agricultural labor, which can impact the cultivation and harvesting of rice.
4. **Market Price Volatility:** Fluctuating market prices for rice can affect farmers' incomes and financial stability.
5. **Pests and Diseases:** Rice crops are vulnerable to various pests and diseases that can reduce yields and quality.
6. **Access to Finance:** Limited access to credit and financing options can restrict farmers' ability to invest in modern equipment and technologies.
7. **Lack of Infrastructure:** Poor rural infrastructure, including roads and storage facilities, can lead to post-harvest losses and increased costs.
8. **Value Chain Inefficiencies:** Inadequate post-harvest handling, storage, and transportation systems can lead to wastage and reduced profitability.
9. **Quality Standards:** Meeting quality and safety standards for both domestic and international markets can be challenging for small-scale farmers.
10. **Changing Consumer Preferences:** Shifting consumer preferences towards organic, non-GMO, or specialty rice varieties may require farmers to adapt their production methods.
11. **Competition and Market Saturation:** The rice market is often competitive and can be saturated with numerous sellers offering similar products. Sellers need to differentiate themselves through branding, innovation, and value-added offerings.
12. **Logistical Challenges:** Efficient transportation and storage are critical components of the rice supply chain. Sellers must address issues related to transportation costs, infrastructure limitations, and timely delivery to prevent disruptions.
13. **Technological Barriers:** While technological advancements offer opportunities, they also present challenges for farmers who lack access to these technologies due to financial constraints or lack of training.

**14. Lack of Knowledge and Training:** Farmers often lack access to up-to-date agricultural knowledge and best practices. Training and extension services are essential to help farmers adopt modern techniques and improve their productivity.

Supply chain management in the rice production industry involves a complex network of processes, organizations, and resources required to bring rice from the field to the consumer. Sellers within this supply chain play a pivotal role in ensuring the efficient movement of rice products, but they also encounter a range of opportunities and challenges that shape their operations and strategies. This dynamic landscape is influenced by factors such as global market trends, technological advancements, environmental considerations, and evolving consumer preferences. In this context, this document delves into the opportunities and challenges faced by sellers operating within the supply chain of rice production, Grieg-Gran, M., & Nihart, A. (Eds.). (2013)).

Therefore, the rice production supply chain faces a blend of opportunities and challenges that stem from the dynamic nature of the industry. Navigating these factors requires a combination of strategic foresight, technological adoption, quality assurance, and adaptability to changing market conditions. By capitalizing on opportunities and effectively addressing challenges, sellers can position themselves for success in the intricate world of rice production supply chains.

### **2.3.2 Opportunities and Challenges Faced by Suppliers in the Rice Production Supply Chain**

#### **Opportunities:**

1. **Growing Demand for Rice:** Rice is a staple food for a significant portion of the global population. As the world population continues to grow, the demand for rice remains strong, providing sellers in the rice production supply chain with a consistent market.
2. **Globalization and Trade:** International trade in rice has expanded, allowing sellers to tap into a broader market. Export opportunities enable sellers to reach regions with deficits in rice production, driving revenue growth.
3. **Technological Advancements:** Technological innovations such as precision agriculture, IoT, and data analytics are enhancing the efficiency of rice production and supply chain operations. Sellers can benefit from improved productivity, reduced costs, and optimized logistics.



4. **Sustainability and Traceability:** Consumers are increasingly conscious of sustainability and the origin of their food. Sellers can differentiate themselves by implementing sustainable practices and providing traceability in their supply chain, which appeals to environmentally conscious consumers.
5. **Value-Added Products:** Diversifying offerings by processing rice into value-added products like rice bran oil, rice flour, and ready-to-eat meals can create additional revenue streams for sellers.

#### **Challenges:**

1. **Price Volatility:** Rice prices can be volatile due to factors like weather conditions, global market trends, and political decisions. Sellers need to manage price risks effectively.
2. **Supply Chain Complexity:** The rice supply chain involves multiple stages, from cultivation to processing, storage, and distribution. Coordinating these stages can be challenging, particularly in regions with inadequate infrastructure.
3. **Quality Control:** Maintaining consistent rice quality throughout the supply chain can be difficult. Sellers need to implement rigorous quality control measures to ensure consumer satisfaction.
4. **Competition:** The rice market is competitive, with numerous sellers operating locally and globally. Sellers must differentiate themselves through branding, quality, and customer service.
5. **Environmental Concerns:** Rice production can have environmental impacts, such as water usage and methane emissions from paddies. Sellers must address these concerns to meet sustainability goals.
6. **Regulatory Compliance:** Adhering to international trade regulations, food safety standards, and labeling requirements can be complex, especially when selling across borders.
7. **Infrastructure and Logistics:** Inadequate transportation, storage facilities, and logistics infrastructure in certain regions can lead to post-harvest losses and supply chain inefficiencies.
8. **Changing Consumer Preferences:** Consumer preferences are evolving, with demands for organic, non-GMO, and healthier rice options. Sellers must adapt to these changing preferences.

Suppliers in the rice production supply chain should stay informed about the latest developments in the industry to adapt and seize new opportunities while addressing emerging challenges, Wang, J., & Marchant, M. A. (2017).

### **2.3.3 Opportunities and Challenges Faced by Millers in the Rice Production Supply Chain**

Millers play a crucial role in the rice production supply chain, as they are responsible for processing paddy rice into edible rice that can be consumed by consumers. This stage in the supply chain involves various opportunities and challenges:

#### **Opportunities:**

1. **Value Addition:** Millers have the opportunity to add value to the raw product (paddy rice) by converting it into a more marketable and consumer-friendly form (edible rice). This value addition can lead to increased profitability.
2. **Quality Control:** Millers can implement quality control measures to ensure that the final rice product meets specific standards in terms of texture, appearance, taste, and nutritional value. This can lead to higher consumer satisfaction and increased demand.
3. **Market Diversification:** Millers can explore different rice varieties and processing techniques to cater to diverse consumer preferences and market segments, thereby expanding their customer base.
4. **Innovation:** There's room for innovation in rice processing technology, such as improving milling efficiency, reducing wastage, and developing new rice-based products, which can lead to competitive advantages.
5. **Supply Chain Collaboration:** Collaborating with other stakeholders in the rice supply chain, such as farmers, distributors, and retailers, can lead to improved coordination, streamlined processes, and better market access.

#### **Challenges:**

1. **Raw Material Quality:** The quality of paddy rice received by millers can vary significantly, affecting the quality of the final product. Inconsistent quality can lead to challenges in maintaining product standards.

2. **Processing Efficiency:** Efficient milling processes are essential to reduce processing time, energy consumption, and wastage. Challenges in achieving optimal efficiency can impact operational costs and profits.
3. **Regulatory Compliance:** Millers need to adhere to various food safety and quality regulations. Ensuring compliance with these regulations can be complex and time-consuming.
4. **Market Competition:** The rice industry can be highly competitive. Millers face competition from both large-scale rice processors and smaller, specialized processors. This can put pressure on pricing and profitability.
5. **Price Fluctuations:** The price of paddy rice can be volatile due to factors like weather conditions, supply and demand dynamics, and global market trends. These fluctuations can impact profit margins for millers.
6. **Technological Advancements:** Staying updated with the latest rice processing technologies is crucial. Failure to adopt modern equipment and techniques can lead to inefficiencies and reduced competitiveness.
7. **Environmental Concerns:** Rice milling can generate waste, including husks and bran. Disposing of these byproducts in an environmentally responsible manner can be a challenge.
8. **Labor Shortages:** Finding skilled labor for rice processing can be difficult in some regions. Automation could help address this challenge, but it requires upfront investment.
9. **Infrastructure:** Adequate infrastructure, such as transportation and storage facilities, is necessary for efficient rice milling operations. Inadequate infrastructure can lead to delays and increased costs.
10. **Consumer Preferences:** Changing consumer preferences, including a shift towards healthier and more sustainable food options, can impact the demand for specific rice varieties and processing methods.

In navigating these opportunities and challenges, millers need to focus on efficiency, quality, innovation, and collaboration within the supply chain to ensure the sustainable production of high-quality rice products that meet market demands. While millers contribute significantly to the food industry, they also face a multitude of opportunities and challenges that impact their operations, efficiency, and profitability. These opportunities and challenges, shedding light on the intricate dynamics within the rice production supply chain. By understanding these factors, stakeholders can make

informed decisions to enhance the sustainability and effectiveness of the entire chain M., & Malabayabas, A. J. (2015).

#### **2.3.4 Opportunities and Challenges Faced by Retailers in the Rice Production Supply Chain**

The rice production supply chain involves a complex network of activities, from cultivation and harvesting to processing, distribution, and sales. Retailers and exporters operating within this supply chain face both opportunities and challenges that can significantly impact their business operations and profitability. There are overview of some of these opportunities and challenges:

##### **Opportunities:**

1. **Growing Demand:** Rice is a staple food for a large portion of the global population. The growing global population, especially in developing countries, leads to a consistent demand for rice products.
2. **Diversification of Products:** Retailers and exporters can take advantage of the various rice varieties available, offering customers a wide range of options such as white rice, brown rice, specialty rice (jasmine, basmati, etc.), and rice-based products like rice flour and rice snacks.
3. **Export Markets:** Exporters have the opportunity to tap into international markets, catering to the preferences of different cultures and regions. High-quality rice varieties are often in demand globally.
4. **Technological Advancements:** Advances in agricultural technology, such as precision farming techniques and modern machinery, can improve production efficiency and quality.
5. **Supply Chain Integration:** Collaboration and integration within the supply chain can lead to streamlined operations, reduced wastage, and improved traceability, enhancing the overall value proposition for consumers.
6. **E-Commerce and Direct Sales:** Online platforms provide a direct channel for retailers and exporters to reach consumers without the need for intermediaries, potentially increasing profits and reducing costs.
7. **Sustainable Practices:** Retailers and exporters can capitalize on the growing demand for sustainably produced rice by promoting environmentally friendly farming and processing methods.

### **Challenges:**

1. **Price Fluctuations:** Rice prices can be highly volatile due to factors like weather conditions, geopolitical issues, and global market dynamics. Retailers and exporters may struggle to manage these price fluctuations and maintain stable profit margins.
2. **Quality Control:** Ensuring consistent quality in rice products is crucial for retaining customer trust. Variability in quality can lead to customer dissatisfaction and harm the reputation of retailers and exporters.
3. **Supply Chain Complexity:** The rice supply chain involves multiple stages, from cultivation to retailing, each with its own set of challenges. Coordinating and managing this complex chain can be difficult, especially in regions with inadequate infrastructure.
4. **Environmental Concerns:** Rice production can have environmental impacts, including water usage and greenhouse gas emissions. Retailers and exporters may face pressure to adopt more sustainable practices to mitigate these concerns.
5. **Regulations and Standards:** Exporting rice products to different countries requires compliance with various regulations and quality standards. Navigating these requirements can be time-consuming and costly.
6. **Competition:** The rice market can be highly competitive, with numerous players vying for customers' attention. Retailers and exporters need to differentiate themselves through quality, variety, branding, and customer service.
7. **Market Access:** Gaining access to new markets, both domestic and international, can be challenging due to trade barriers, tariffs, and import/export regulations.
8. **Seasonal Nature of Rice Cultivation:** Rice cultivation is often seasonal, leading to fluctuations in supply. Retailers and exporters must plan their operations carefully to manage inventory and meet customer demand throughout the year.
9. **Technological Adoption:** While technological advancements offer opportunities, adopting new technologies can be costly and require training for the workforce.

10. **Political and Economic Stability:** Retailers and exporters operating in regions with political instability or economic volatility may face disruptions to their operations and supply chains.
11. **Infrastructure and Logistics:** Inefficient transportation and storage infrastructure in certain regions can lead to delays, spoilage, and increased costs.

To navigate these opportunities and challenges successfully, retailers and exporters in the rice production supply chain need to adopt a proactive and adaptive approach. This might involve investing in quality control, sustainable practices, supply chain optimization, market research, and fostering strong relationships with suppliers, customers, and relevant regulatory bodies, Brown, C., & Miller, S. (2008).

Retailers and exporters in the rice production supply chain have significant opportunities to tap into global demand, add value through diversification and technological integration, and cater to sustainability trends. However, they must navigate challenges related to supply chain complexity, quality control, regulations, and more. By addressing these challenges effectively, retailers and exporters can establish themselves as key players in the rice industry.

### **2.3.5 Opportunities and Challenges Faced by Consumers in the Rice Production Supply Chain**

The rice production supply chain is a complex system that involves multiple stages, from cultivation to processing, distribution, and consumption. Consumers play a critical role in this supply chain as the ultimate end-users of the product. While there are several opportunities for consumers within this chain, there are also significant challenges that they encounter, Khush, G. S. (2005). The consumer faced by consumers in the rice production supply chain.

#### **Opportunities for Consumers:**

1. **Access to Diverse Varieties:** Consumers benefit from a wide variety of rice types, ranging from long-grain to short-grain, white to brown, and aromatic to non-aromatic varieties. This variety allows consumers to choose rice that aligns with their preferences, cultural practices, and nutritional needs.
2. **Nutritional Value:** Rice is a staple food for a large portion of the global population, providing essential carbohydrates and energy. Additionally, brown

rice offers higher nutritional value compared to white rice due to its bran and germ layers that contain fiber, vitamins, and minerals.

3. **Cultural Significance:** Rice holds significant cultural importance in many societies. Consumers can engage in cultural practices by choosing specific rice varieties for traditional dishes and celebrations, preserving cultural heritage.
4. **Consumer Education:** With increasing awareness about food safety, sustainability, and health, consumers have the opportunity to educate themselves about the sources of their rice, production methods, and potential impacts on the environment and their health.
5. **Sustainable Choices:** Consumers can support sustainable practices by choosing rice produced using environmentally friendly methods, such as organic or agroecological farming practices. This choice encourages environmentally responsible production.
6. **Market Competition:** A competitive rice market encourages producers to innovate, improve quality, and offer value-added products to attract consumers, leading to better options for consumers.

### **Challenges**

1. **Quality and Safety Concerns:** Consumers often face challenges related to rice quality and safety. These can include concerns about contamination, pesticide residues, and the presence of adulterants or contaminants during processing and packaging.
2. **Supply Chain Transparency:** Lack of transparency in the supply chain can make it difficult for consumers to trace the origin of the rice they purchase. This can hinder their ability to make informed decisions about the environmental and social impacts of their choices.
3. **Price Fluctuations:** Consumers may experience fluctuations in rice prices due to factors such as weather conditions, market demand, and transportation costs. These price variations can impact their food budgets and purchasing decisions.
4. **Cultural Erosion:** Globalization and urbanization can lead to a shift away from traditional rice varieties and consumption practices, potentially eroding cultural heritage and local agricultural diversity.
5. **Sustainability Challenges:** Unsustainable rice production practices, such as excessive use of water and chemicals, can have negative environmental impacts.

Consumers may find it challenging to identify and support sustainable rice sources.

6. **Information Asymmetry:** Limited access to information about the origin, production methods, and sustainability of rice can make it challenging for consumers to make informed choices.
7. **Environmental Impact:** Unsustainable rice production practices can have negative environmental effects, such as water pollution, habitat destruction, and greenhouse gas emissions, which indirectly affect consumers and future generations.

#### 2.4 Reviews on Previous Studies

As part of a literature review on, a study of the rice production supply chain in Phyapon township, Ayeyarwady region the following studies were observed.

Thin Yu Soe, (2015) investigated "Study on Supply Chain of the Selected Vegetables in Mon State". Supply chain inefficiency results in post-harvest losses and wastes, which ultimately raise consumer prices and reduce income for farmers and other stakeholders. The study's objectives were to examine the performance of the major players in the vegetable supply chain, analyze the distribution of production costs and profits among the chain's key players, and pinpoint obstacles to the chain's improvement for the good of all key players. The study was conducted among 100 vegetable growers, 11 collectors, 14 wholesalers, and 16 retailers from the Belin, Mawlamyine, Paung, and Thaton Townships using a simple random sample procedure. According to the findings, the majority of vegetable growers were smallholder farmers with farms that were on average 0.37 hectares in size. Farmers have limited access to land and water for year-round vegetable cultivation, and around 50% of the world's arable land is lowland. Nearly the majority of the veggies were imported during the off-season from other regions, including Shan State, Sagaing Division, Naypyitaw Division, Bago Division, Yangon Division, and Thailand. In Mon State, yard-long beans, cucumbers, eggplants, mustard, and tomatoes were the most commonly produced vegetables.

Hteh Htet Htun, (2013) investigated "Supply Chain Management of Groundnut Production in Magway Township". To analyze the factors affecting groundnut supply and profit at the farm level in Magway Township, study the operation of current groundnut marketing channels, analyze marketing costs and margins along the



groundnut marketing channels, and identify significant groundnut marketing challenges and opportunities. Magway Township's three villages (Magyigan, Phoelaylone, and Tapauktaw) were the locations of the survey, which was carried out from December 2012 to January 2013. 90 farmers, 5 distributors, 5 proprietors of hullers, 5 millers, and 1 processor made up the chosen sample sizes. Market actors in the groundnut supply chain, such as regional distributors, huller owners, and processors (who make groundnut brittle and edible oil), are all well-rounded. The research area's average yield of groundnuts (80 bsk/acre) was higher than the national target yield of groundnuts (50 bsk/ac). The "Tontarni" type of groundnut was the most widely grown due to its high yield and resistance to pests and disease.

Linn, T., & Maenhout, B. (2019) investigated "The impact of environmental uncertainty on the performance of the rice supply chain in the Ayeyarwaddy Region". In this article, we investigate the relationship between environmental uncertainty and supply chain performance for rice in Myanmar's Ayeyarwaddy Region. Efficiency is a crucial performance metric for the agriculture supply chain. In this context, the study's goals are to quantify the effectiveness of the rice supply chain, identify the many sources of uncertainty that the various participants in the chain perceive, and investigate the effects of environmental uncertainty on supply chain effectiveness. Purposive and stratified random sampling is used to collect data from 215 respondents in the Ayeyarwaddy Region, and this data is then analyzed using descriptive statistics, an exploratory factor analysis, data envelopment analysis (DEA), and Tobit regression analysis. Because most rice firms are too small and need to increase their operating size, the rice supply chain in the Ayeyarwaddy Region performs very poorly according to the technical, pure, and scale efficiency scores.

Williams, G. J. (2021) investigated "Developing a Fairtrade rice supply chain from Myanmar: achievements, challenges, lessons". The case study presented here is of rice sourced from smallholder farmers in Myanmar's Ayeyarwady region: the world's first Fairtrade product from Myanmar. The case study illustrates how Traidcraft Exchange's explicit focus on small producers and innovating new supply chains from 'left behind' communities can work in practice. It explains challenges faced at both the supplier and market end. It seeks to show how broader programmatic aims to strengthen small producer skills and organizational capacity to engage with trade on fairer terms can mitigate risks associated with export trade to the challenging UK market. In this

case study, rice from smallholder farmers in Myanmar's Ayeyarwady region—the first Fairtrade product from that country—is used.

Thwin, N. K. S., Takahashi, K., & Maeda, K. (2016), investigated "The activities of rice specialized companies in the supply chain of rice in Myanmar". To address issues with impure seeds, inferior agrochemicals, a lack of updated technologies and credit, and poor agricultural infrastructure, the government of Myanmar established the policy of granting export permits to RSCs with contract farming records. RSCs attempted to improve the supply chain for rice in Myanmar in 2008. However, from 2011–2012, the activities of RSCs have declined as a result of the above-mentioned regulatory shift and the subpar contract farmer payback rate. It is claimed that supply chain operations are negatively impacted by the fall of RSCs.

Rath, B., Wonginta, T., & Amchang, C. (2022), investigated "Risk analysis of the rice supply chain in Cambodia." This paper aims to analyze the risks faced by the Cambodian rice supply chain (RSC), including risk identification, risk investigation and risk management. The authors collect quantitative data from 200 Cambodian farmers through interviews and surveys. The results illustrate that the farm households face 18 risk factors. The researchers consolidate 18 risk factors into four classifications: supply risks, production risks, demand risks and environmental risks. Nine experts out of the ten who were interviewed (90%) consider themselves "highly vulnerable" (with a rating of 4 or 5 on the Likert scale), while only one expert has a "neutral" stance (with a rating of 3 on the Likert scale); these results concerning risk identification are visualized in the likelihood effect matrix of the RSC.

Canavari, M., & Darnhofer, I. (2012), investigated "Export Conditions of Myanmar Mango: Hindrances and Opportunities in the Supply Chain." Mango (*Mangifera indica* Linn) plays a central role as fruit crop among the horticultural fruits in Myanmar. This research is the first-of-its-kind in the area of mango supply chain and exporting in Myanmar. It mainly focuses on hindrances and opportunities of mango exporting faced by growers, marketers and exporters. In this research, two different regions, Mandalay Division and Southern Shan State, were selected as study areas in Myanmar. An exploratory research approach was applied to investigate hindrances and opportunities in mango supply chain. By using purposive and snowball sampling procedure, thirty-two respondents were recruited, including 12 growers, 8 marketers, 6 exporters and 6 experts from Yangon Division, Mandalay Division and Shan State.

Indepth interviews combined with participatory observations in the field were conducted along the mango supply chain from February to May 2012.

Soe, J. (2015), investigated “Fertilizer supply chain and market structure: A case study in Tatkon Township, Nay Pyi Taw (Doctoral dissertation, Yezin Agricultural University)”. This study was attempted to explore the detailed information about marketing performance of fertilizer markets. The overall objective of the study was to analyze the fertilizer supply chain and fertilizer market structure in Tatkon Township. The specific objectives are to identify marketing activities of market participants including end users (farmers) in Tatkon Township, to examine fertilizer market structure including marketing channel, marketing cost and marketing margin in Tatkon Township and, to study the fertilizer price integration during 2010 to 2014 period. The survey was conducted in January, 2015 with marketing intermediaries. A total of 33 market intermediaries were personally interviewed in which 6 local wholesalers, 5 village retailers from Nwe Yit, Kyaе Chaung and Moe Hnan Khone villages, 2 company agents (Diamond Star Co., Ltd and Golden Lion High Tech Agricultural Resources Co., Ltd) and 20 farmers in New Yit, Kyaе Chaung and Moe Hnan Khone villages were collected.

Lei, S. Y. W. (2016), investigated “Assessment on Cabbage and Cauliflower supply chain management in Kalaw Township, Southern Shan State (Doctoral dissertation, MERAL Portal)”. In this study, the socioeconomic characteristics, cost and benefit, factors affecting yield determinants of cabbage and cauliflower production and constraints and challenges of production and marketing were investigated. The primary data were collected by interviewing 100 non-contract farmers in Myinmahti and Heho village tracts, 30 contract farmers in Kyauthtet, Heho and Thekhaung village tracts, and 34 sample market intermediaries in Kalaw Township during October to November, 2015. Descriptive analysis, cost and return analysis, marketing cost, margin and profit, production function analysis and SWOT analysis were used. According to the findings, both non-contract and contract farmers were at the primary education level. Home assets and luxury assets of non-contract and contract farmers were not significant.

Kennedy, S. F. (2014), investigated “From certification outcomes to certification processes: Demand, supply and adoption of eco-certification along the natural rubber supply chain.” Following a review of the literature on eco-certification and the emergence of private regulation more broadly, I provide an overview of the

global rubber industry and the range of environmental and social impacts – both positive and negative – that characterize the natural rubber product lifecycle. In Part 3 I present an overview of current mandatory and voluntary standards promoted as having the potential to overcome environmental and social concerns, and iv assess the extent to which these standards align with the broader negative impacts identified in Part 2. In Part 4, I examine the processes that have given rise to particular forms of ecocertification by examining the motivations of a set of actors along the rubber commodity chain who are currently involved in the production, consumption or certification of certified latex products.

## **CHAPTER III**

### **BACKGROUND INFORMATION OF RICE PRODUCTION SUPPLY CHAIN IN AYEYARWADY REGION**

#### **3.1 Overview of Rice Production in Myanmar**

The three major crops in the world—rice, wheat, and maize—directly provide over fifty percent of the total quantity of calories needed by the whole human population. With a yearly production of 214 million ha, wheat is one of the most widely grown crops in the world. With 154 million ha, rice comes in second, followed by maize with 140 million ha. 85% of the total production of rice is used for human consumption, versus 72% for wheat and 19% for maize. Rice yields 21 percent of the world's human per capita energy and fifteen percent of each person's protein.

Despite having a relatively low protein level, rice protein ranks highly in terms of nutrition when compared to other cereals. Additionally, rice contains fiber, vitamins, and minerals, albeit milling reduces all nutrients other than carbohydrates. The largest intake was seen in various Asian nations, with Myanmar having the highest yearly consumption at 211 kg per person. The average amount of rice consumed worldwide in 1999 was 58 kg. The majority of the world's poor are rice consumers and producers; in the region of Asia, where rice is a staple diet, 70% of the 1.3 billion impoverished people dwell (UNDP, 1997).

Numerous factors affect the supply chain for rice cultivation in Myanmar. Rice is a staple diet for the vast majority of people in Myanmar, one of the world's top producers of grain. The supply chain for rice production in Myanmar encompasses various stages from cultivation to processing, distribution, and export. The supply chain's reasoning is influenced by several important variables, including the potential for agriculture, domestic consumption, exports, smallholder farming, infrastructural development, government backing, and dynamics of global trade.

To ensure food security at the local and national levels as well as to provide jobs and income for a burgeoning population, agriculture plays a significant part in Myanmar's society. The primary source of employment in rural Myanmar and a key

component of the country's domestic economy is agriculture. According to the World Bank (2014), one of the key engines for economic expansion and the foundation for enhancing social well-being is the agriculture sector. The agricultural sector, which helps to promote rural development and earn foreign cash through agricultural exports, is crucial to promoting economic growth and reducing poverty. More than half of the population works directly in agriculture, which is the foundation of Myanmar's economy. As a result of structural change, agriculture's significance as an employer in the economy will decline in the years to come. But for many years to come, the industry will continue to make a significant contribution to eradicating poverty in Myanmar (World Bank, 2014).

Rice is a significant staple crop in Myanmar, where nearly all of the population relies heavily on it for nutrition. Regarding consumption, around 66 percent of the population's daily caloric intake comes from rice (Myint, 2018). Additionally, rice helps reduce poverty in Myanmar and ensures food security, while also boosting export revenues and the national economy. As a result, increasing rice production is crucial to Myanmar's socioeconomic development.

With its good soil, plentiful water supplies, and adequate temperatures, Myanmar offers ideal agroclimatic conditions that make it an excellent place to grow rice. The nation is a prominent player in the world rice market thanks to its extensive fertile territory and long history of rice farming. Myanmar's primary food staple is rice, which is in considerable demand domestically. The populace mainly depends on rice as a food staple and a sizable amount of their daily caloric intake comes from it. As a result, the supply chain is set up to guarantee a steady and ample supply of rice to satisfy domestic consumption requirements.

Rice is an important export from Myanmar, especially to its Southeast Asian neighbors. The supply chain for rice production is set up to maximize export possibilities and benefit from Myanmar's closeness to important markets. Because of the nation's advantageous location, rice can be transported quickly to nearby nations like China, Bangladesh, and Thailand. In Myanmar, smallholder farmers who grow rice on little parcels of land make up the majority of the industry. These smallholder farmers have access to inputs like seeds, fertilizer, and machinery thanks to the supply chain's architecture, which takes their requirements into account. To assist smallholder farmers and make it easier for them to participate in the supply chain, cooperative farming models and farmer groups are essential.

To increase the effectiveness of the rice supply chain, Myanmar has been investing in infrastructural development. This entails creating storage facilities, expanding processing and milling capabilities, and improving transportation networks. Increasing storage capacity, lowering post-harvest losses, and facilitating the transportation of rice from rice-producing areas to markets and ports are all goals of infrastructure development.

The Myanmar government is essential in assisting the supply chain and supporting the rice sector. It puts policies and plans into action to support agricultural growth, boost farming methods, and increase the overall productivity of the rice industry. Subsidies, credit lines, R&D projects, and market-enablement tools are all examples of this support. The rationale behind Myanmar's rice supply chain is influenced by the dynamics of the world's rice market and commerce. International demand, market prices, and competition from other rice-producing nations all influence the nation's export-oriented strategy. The movement of rice along the supply chain is further impacted by export laws, quality requirements, and trade agreements. To ensure a consistent and effective flow of rice from farmers to consumers, both domestically and globally, these elements work together to form the structure and operation of the rice supply chain.

The summer paddy program, which was started in 1992/93, was the primary component of rice production policy following 1988, as was previously mentioned. Both in Lower Myanmar and the dry zone of Upper Myanmar, irrigation investment was essential for fostering the production of summer paddy. The program was essentially an irrigation development effort in this sense

The following two components are typically implied by a policy of agricultural exploitation. To encourage industrialization, food prices are first suppressed and salaries are kept at a low level. Second, export crops are bought at a discount from the market rate, and the proceeds are used to support industrialization. In this regard, Myanmar's socialist-era rice policy was an example of an agricultural exploitation policy. The government monopolized rice exports, which at the time became the main source of foreign exchange earnings, in addition to introducing a compulsory paddy procurement system at below-market prices and a system of rationing the supply of affordable rice to consumers through people's shops and cooperatives.

Since Myanmar had no particular advantage in this field, the socialist government implemented a program of self-sufficiency in the manufacture of edible

oils. Even though an acquisition and rationing system similar to the one used for rice production was adopted concerning oilseed crops such as sesame and groundnuts, it was very likely that the domestic price of edible oil was significantly higher than the international price. As a result, farmers were "protected" by limiting imports.

The importation of edible oil increased significantly after 1988, as will be discussed later. As a result, the price of domestic edible oil was reduced to a level that was comparable to the price on a global scale. On the other hand, exports of pulses and beans significantly increased and quickly overtook all other exports from Myanmar. As time went on, the domestic price of pulses rose quickly. Beans and pulses underwent a rapid process of price adjustment to the global market. In this sense, the end of the closed trade regime that had been separating the domestic market from the global market has been the biggest development in Myanmar agriculture since 1988.

Contrarily, the domestic price of rice has been constantly suppressed since 1988 at a rate that is around half that of the international rate, albeit the difference has gradually decreased. As recently as now, they have started to be imported only for commercial purposes, and the essential inputs required for rice growing (chemical fertilizer and diesel oil) have strengthened their ties to the global market. This means that the rice sector in Myanmar has itself strengthened its linkage with the international market, albeit in a rather asymmetric way, and with the result that in this respect, the sufferings of the Myanmar government and the farmers have come to converge.

According to Takahashi (Takahashi 2001), farmers in Myanmar were still subject to the "three internal major agricultural systems" that had been left over from the socialist era. These systems included the procurement system, the planned cropping system, and state ownership of farmland. One may even claim that the government tightened these procedures to regulate farmers after 1988. Nevertheless, the current wave of internationalization is also forcing Myanmar's agriculture to adapt. Given that internationalization is unavoidable, the secret to effective reform of the domestic control systems is to figure out how to maximize its benefits while limiting its drawbacks. This article aims to emphasize the transition to an open economy rather than the transition to a market economy generally when analyzing trends in the agricultural sector after 1988.

The main crops grown in Myanmar fall into four categories: those grown for export, those grown to compete with imports, those grown for the domestic market, and those grown for state-owned enterprises. the variations in the rate of price growth across



crops in this regard. First, the pace of price increase was often relatively high for export products. Due to the stimulation provided by rising worldwide prices, domestic prices, which had been artificially depressed at a very low level, have increased drastically. This has caused production and exports to expand significantly. Second, because the growth in imports prevented a spike in local prices, the price of import-competition crops only slightly increased. Third, the cost of crops intended for the domestic market rose significantly. The high-income elasticity of goods like vegetables, meat, and fisheries products may easily be the cause of this.

After 1988, the agricultural sector played a crucial part in Myanmar's economic recovery and expansion, and this significance persisted into the mid-1990s. The farmers were given price incentives, which in large part made this possible. In general, the 1987 agricultural marketing reforms were successful in establishing an adjustment between formerly severely suppressed farm prices and worldwide prices. Not just for a few (but significant) export crops, but also for a range of crops destined for the domestic market, the rate of price growth was quite high. Farmers took advantage of the new business prospects swiftly.

For the people of Myanmar, oil is a necessity, therefore any sudden spike in price might be quite concerning for the government, though to a lesser extent than in the case of an increase in the price of rice. By boosting imports, the government may make an effort to keep domestic prices low. There are instances when domestic price increases take place, which greatly concerns the government. The significant swings in import volumes of palm oil over the past few years could be interpreted as a "swing" in the government's efforts to address the issue.

Similar issues arise with rice because it is prioritized above all else to keep prices stable at low levels. However, rice is the crop in which Myanmar has a comparative advantage, and various internal "regulative" policies can be used to stabilize prices. Oilseed crops, however, are an exception because Myanmar has no competitive advantage in them. If imports are prohibited, there is no way to make up for it by improving domestic production efficiency. The alternative, in which all of Myanmar's oilseed supplies depend on arbitrary political decisions, is challenging and risky.

The monoculture pattern of rice and teak wood dominating Myanmar's export structure has changed, and the country now has a diverse export structure that includes both agricultural and non-agricultural goods, the latter of which has gained importance

in recent years. It should be noted, nevertheless, that natural gas and clothing represent a significant portion of non-agricultural commodity exports. As a result, agricultural exports continue to be crucial for Myanmar's economy.

### **3.2 Overview of Rice Production in Ayeyarwaddy Region**

Myanmar consumes a lot of rice per person, and the Ayeyarwaddy region plays a significant role in meeting the domestic demand for rice. The Ayeyarwaddy Region consists of six districts: Myaungmya, Patheingyi, Hinthada, Maubin, Pyawbwe, and Labutta. Additionally, Myanmar has been a major rice exporter in the past, and the Ayeyarwaddy region's rice production contributes to the country's export potential. The presence of infrastructure and logistics support, such as transportation networks, storage facilities, and milling and processing units, plays a vital role in the supply chain for rice production. These facilities facilitate the movement of paddy from farms to markets, as well as the processing and packaging of rice for distribution.

While rice may be grown in all of Myanmar's states and regions, the Ayeyarwaddy Region is well-known for producing rice due to its ideal soil composition and climate. Out of 14 states and regions, this one has the highest amount of rice sown (28.29% of the total area). In this area, rice is grown on two-thirds of the total arable land. For this reason, this area is referred to as Myanmar's "rice bowl" or "granary." In 2008, MOAI brought GAPs of rice to this area and has since pushed farmers to employ this technology. This area's soil and climate are ideal for applying rice GAPs during both the rainy and dry seasons rice production occurs in two seasons (the rainy season, which lasts around five months from July to November, and the dry season, which lasts roughly four months from December to March).

The Ayeyarwaddy region is situated approximately between longitudes 94 degrees 15' and 96 degrees 15' east as well as between latitudes 15 degrees 40' and 18 degrees 30' the north. It is 35,140 square kilometers in size (13,566 sq mi). The number of people is expected to reach above 6.5 million in 2022. The Ayeyarwaddy District is the second most populated state in Burma, with 6,184,829 people living there as stated in the 2014 Myanmar National Population. Following Yangon Region, it consists of 33 townships and six districts. The Ayeyarwaddy Region in Myanmar is an important agricultural region, known for its rice production. The supply chain for rice production in the Ayeyarwaddy Region can be attributed to several factors; favorable agricultural conditions, traditional rice cultivation, economic importance, local consumption and

export potential, infrastructure and logistics, government support and policies, and market demand.

Ayeyarwaddy Region benefits from fertile deltaic soils, abundant water resources, and a tropical monsoon climate, which are highly conducive for rice cultivation. The region receives ample rainfall and is traversed by the Ayeyarwaddy River, providing irrigation for paddy fields. Rice has been a staple crop in Myanmar for centuries, and the Ayeyarwaddy Region has a long history of rice cultivation. Farmers in the region possess traditional knowledge and expertise in growing rice, making it a viable and familiar agricultural practice. Rice is a crucial agricultural commodity and a major source of income for farmers in the Ayeyarwaddy Region. The production and sale of rice contribute significantly to the regional economy and provide livelihood opportunities for a large number of people.

To guarantee a consistent flow of rice from farms to consumers and export markets, the supply chain of rice production in this region is essential. Rich natural resources, a long-standing farming community, coordinated farming methods, nearby rice milling facilities, storage and distribution hubs, effective transportation infrastructure, accessibility to export markets, government support and policies, and technological integration are all part of the Ayeyarwaddy region's rice production supply chain.

The Ayeyarwaddy region is endowed with fertile deltaic soils and a favorable climate for rice cultivation. The region's flat and well-irrigated lands are ideal for growing rice, making it a prime agricultural area in Myanmar. Given its significance in the local diet, the demand for rice is consistently high, both for domestic consumption and export purposes. Therefore, the supply chain is designed to meet this substantial demand. The Ayeyarwaddy region has a long history of rice cultivation, and its farmers have developed expertise in growing rice efficiently. The farming population in the area is essential to the supply chain since they guarantee a consistent rice harvest throughout the whole year. In the Ayeyarwaddy region, farmers collaborate frequently and follow synchronized planting and harvesting schedules. This synchronization lessens shortages and price swings by ensuring a steady supply of rice.

Rice mills are strategically located in the region to process paddy into milled rice. These facilities help in improving the quality and value of the rice before it enters the market. Having milling facilities nearby reduces transportation costs and post-harvest losses. The Ayeyarwaddy region benefits from a well-developed transportation

network, including roads, waterways, and railways, which facilitates the movement of rice from farms to mills, storage facilities, and markets. There are storage facilities strategically positioned throughout the region to store excess rice and buffer against fluctuations in supply and demand. These centers ensure a steady supply of rice, even during off-peak seasons.

The authorities of Myanmar have instituted policies and plans to enhance rice production and improve the supply chain, acknowledging the sector's significance. Subsidies, financial availability, technical support, and infrastructure development projects are all included in this. Not only is rice a staple diet in Myanmar, but it is also in many of the world's adjacent nations. There is a rice market produced within the Ayeyarwaddy District since there is a steady demand for rice both domestically and internationally. The feasibility and importance the rice production in the region's agricultural sector is influenced by these factors.

Myanmar's major entry point for rice exports is the Ayeyarwaddy area. As a result, the supply chain is designed to meet the needs of both domestic and foreign consumers, including those in China, Thailand, and other nearby nations. The supply chain for rice production is greatly aided and abetted by the government of Myanmar. It puts laws into action to guarantee fair trade practices, keep prices stable, and give exporters, millers, and farmers incentives. The agricultural supply chain has been using technology more and more in recent years. This includes digital platforms for information sharing and market access, robotic cultivation, and better irrigation techniques.

### **3.3 Overview of Rice Production in Pyapon Township**

The Ayeyarwady Delta, which is bisected by several rivers and waterways, is home to Phyapon. Rice farming requires a consistent supply of water for irrigation, which these water resources offer. Consistent productivity and high-yield rice farming are supported by the plentiful availability of water. Phyapon enjoys the advantages of a comparatively developed transportation system. The area's roads and rivers make it easier to transport rice from rice farms to mills for processing and, eventually, distribution hubs. Effective transportation networks guarantee that rice reaches customers on time and minimize losses after harvest.

Phyapon township is mainly dedicated to the cultivation of the paddys Pawsanyin, Paw sanyin, Pawsan Gyi, Sinthawlat, Yatkoesel, Kyautnyeain, Ngasein and

Nyeankhar. In Myanmar, rice is a staple grain that has major cultural and economic significance. Farmers in Phyapon are motivated to plant and produce rice by the demand for the crop, both locally and globally. A strong supply chain makes it possible for farmers to reach markets and guarantees a consistent supply of rice to satisfy customer demand. The government of Myanmar recognizes the importance of rice production for the country's food security and economy. Policies and support programs are in place to encourage rice cultivation and enhance the efficiency of the supply chain. These initiatives may include agricultural subsidies, research and development, infrastructure development, and marketing assistance.

Overall, the supply chain for rice production in Phyapon is a combination of favorable natural conditions, traditional expertise, market demand, and supportive government policies. These factors work together to create an efficient and sustainable supply chain, ensuring a steady supply of rice to meet local and regional needs.

The main industries in Pyapon Township are agriculture and fishing, and the town's economy is growing and developing slowly overall. There is a robust network of overland transportation and an abundance of navigable rivers. Pyapon is connected between Dala and Hlaingthaya in the Yangon Region by the main road. Except for relatively few off-season winter crops, rice is by far the most widely grown crop. The stress of outmigration is also causing a labor shortage and rising labor expenses in the municipality. Rural Ahmar Subtownship people are pushed toward Pyapon or Hlaingthaya by low income, an abundance of healthcare, and a lack of educational possibilities.

The economy of Pyapon Township is gradually growing and changing. There are plenty of navigable waterways and a high-quality network of overland transit. The principal route in the Yangon Region connects Phyapon with Dala and Hlaingthaya. The most common crop is, by far, rice, with very few winter off-season crops coming in second. The pressures resulting from outmigration also cause a labor shortage and higher labor costs in the township. Due to the absence of work, access to healthcare, and educational opportunities, rural Ahmar Subtownship residents are forced to relocate to Phyapon or Hlaingthaya. Since there are few off-season crops available, the already meager agricultural income is seasonal, which causes many young adults to move to cities when they lose their jobs after the harvest. The municipality has noticed a rise in salinity since Cyclone Nargis made landfall and exacerbated coastal flooding. Salinity problems were affecting 85% of the township's fields, and farm outputs were dropping.

Traditional farming methods are no longer effective, and technology access in the agriculture sector is still restricted.

Along with growing various agricultural animals, the community also has a dairy sector. More than 2000 farms' produce processors operate in the township. The village of Phyapon houses a diesel-powered power plant that uses Siemens-made machinery and serves as a hub for gathering rice from the nearby agricultural districts.

The vast freshwater fisheries in the township are primarily for shrimp. Freshwater fish are caught for the vast majority of the fish products. Within the freshwater, brackish, and marine environments of the municipality, there is a diversified and plentiful fish life. The Perciformes suborder contains the most frequently caught fish.

## **CHAPTER IV**

### **SURVEY ANALYSIS**

#### **4.1 Survey Profile**

The study focused on five villages in Phyapon township's Koeaintan, Kani, Thamainhtaw, Zine Maung and Kyintha (Shan Kwin) village tracts. The selected villages are situated within 10 miles from Phyapon Township. Phyapon township is located in the south-central Ayeyarwaddy region, bordering the Andaman Sea to its south and west. Its northwestern boundary is concave and borders Bogale Township. To its northeast, it borders Kyaiklat Township and Dedaye Township, all within Phyapon District. The township consists of two cities with a total of 23 wards between them, as well as 52 village tracts and 212 villages. Koeaintan has 677 households, Kani has 525 households, Thamainhtaw has 1200 households, Zine Maung has 125 households and Kyintha (Shan Kwin) has 998 households. A total of 273 households were interviewed for the rice production supply chain of rural families in the Phyapon Township study.

#### **4.2 Survey Design**

Using primary data, the survey design is a descriptive analysis. The survey's goal was to look into the rice production supply chain of families living in the countryside Phyapon Township. To gather information, the study began with a sampling process before launching a survey. 273 households in five villages were selected as sample size. 273 households are involved farmers 70 households (25.7%), suppliers 65 households (23.8%), millers 8 households (2.9%), retailers 65 households (23.8%) and consumers 65 households (23.8%). A structured questionnaire was administered to household members who knew everything about the rice production supply chain during a face-to-face interview.

Primary data sources for the focus group discussion included village tract leaders, village leaders, stakeholders. Then there are secondary data sources, for instance, the Township Administration Department, the clerk, and the Internet. Field

the data was collected from between July and August 2023. The questionnaire was divided into five parts. Section I discusses the stakeholder's socio-demographic characteristics; Section II discusses farmers; Section III discusses suppliers; Section IV discusses millers; Section V discusses retailers; Section VI discusses consumers; and Section VII discusses the measurement of the rice production supply chain by stakeholders as a result of the rice production of the supply chain.

### **4.3 Analysis of Survey Results**

#### **4.3.1 Socio- Demographics Characteristics of the of the Respondents**

The percentages of gender, age, education level, occupation, household size, household monthly income, type of business, employment in rice production, year of experiences and landholding size are shown in Table (4.1).

This stakeholder included farmers, suppliers, millers, retailers and consumers. The survey question's personal history summarizes the study area's rice production supply chain history.

According to Table 4.1, 67 farmers (96%) are male, 8 millers (10%) are male, 45 suppliers (69%) are female, 44 retailers (68%) are male, and 42 customers (35%) are male of the total respondents (273). The majority of the farmers are between the ages of 55 and 64, representing 23 (32%), and 3 mailers (37%) are between the ages of 35 and 44 and 45 and 54 of each. Only 29 suppliers (45%) are between 45 and 54 years old, 28 retailers (43%) are between 45 and 54 years old, and 27 customers (41%) are between 45 and 54 years old.

Regarding education, 37 (53% of farmers), 34 (52% of suppliers), and 34 (52%) of retailers have primary education, while 6 (75% of millers) and 32 (49%) of customers have secondary education. Among them, 3 (4%) of farmers, 2 (25%) of millers, 2 (3%) of suppliers, 2 (3%) of retailers, and 14 (22%) of customers have university degrees. Regarding occupation, it shows that 5 farmers (7%), 5 suppliers (8%), 5 retailers (8%), and 40 customers (61%) are private employees, and 65 farmers (93%), 8 millers (100%), 60 suppliers (92%), and 60 retailers (92%) are self-owned businesses. The majority of households have between 3 and 5 family members: farmers, millers, suppliers, retailers, and customers of each.

Concerning the household monthly income of 48 farmers (69%), 45 suppliers (69%), 31 retailers (48%), and 21 customers (32%), it ranged from less than Ks 200,000 per month, and for 18 farmers (26%), 1 miller (13%), 16 suppliers (25%), 25 retailers



(38%), and 33 customers (51%), it ranged from 200,001 kyats to 400,000 kyats per month. About 5 millers (62%) earn 400,001 to 600,000 kyats per month, and 2 millers (25%) receive 600,001 to 800,000 kyats per month.

**Table (4.1) Socio-Demographics Characteristics of the Respondents**

No.	Particulars		Farmers	Millers	Suppliers	Retailers	Customers
1.	<b>Gender</b>						
	Male	No.	67 (96)	8(1000	20(31)	44(68)	23(35)
	Female	(%)	3 (4)	0(0)	45(69)	21(32)	42(65)
	<b>Total</b>		70(100)	8(100)	65(100)	65(100)	65(100)
2.	<b>Age</b>						
	25 - 34 years	No	1 (1)			4(6)	3(5)
	35 - 44 years	(%)	9 (13)	3(37)	12(18)	17(26)	26(40)
	45 – 54 years		20(27)	3(37)	29(45)	28(43)	27(41)
	55 – 64 years		23(32)	2(26)	22(34)	16(25)	9(14)
	65 years & above		17(27)		2(3)		
	<b>Total</b>		70(100)	8(100)	65(100)	65(100)	65(100)
3.	<b>Education</b>						
	Primary	No	37(53)		34(52)	34(52)	19(29)
	Secondary	(%)	30(43)	6(75)	29(45)	29(45)	32(49)
	University		3(4)	2(25)	2(3)	2(3)	14(22)
	Master and above			-	-	-	-
	<b>Total</b>		70(100)	8(100)	65(100)	65(100)	65
4.	<b>Occupation</b>						
	Government Sector						20(31)
	Private Employee	No	5(7)		5(8)	5(8)	5(8)
	Self-Owned Business	(%)	65(93)	8(100)	60(92)	60(92)	40(61)
	Informal Sector Others						
	<b>Total</b>		70(100)	8(100)	65(100)	65(100)	65(100)
5.	<b>Household Size</b>						
	1 to 3	No	20(29)	2(25)	19(29)	19(29)	29(45)
	3 to 5	(%)	46(66)	6(75)	43(66)	43(66)	27(42)
	5 to 8		4(5)		3(50)	3(50)	9(13)
	Above 8						
	<b>Total</b>		70(100)	8(100)	65(100)	65(100)	65(100)

**Table (4.1) Socio- Demographics Characteristics of the Respondents (Continued)**

No.	Particulars		Farmers	Millers	Suppliers	Retailers	Customers
<b>6. Household Monthly Income</b>	Less than Ks200,000Ks	No (%)	48(69)	1(13)	45(69)	31(48)	21(32)
	200,001 – 400,000Ks		18(26)	5(62)	16(25)	25(38)	33(51)
	400,001 – 600,000Ks		3(4)	2(25)	3(5)	7(11)	9(14)
	600,001 – 800,000Ks		1(1)		1(1)	2(3)	2(3)
	Above 800,000ks						
	<b>Total</b>			70(100)	8(100)	65(100)	65(100)
<b>7. Type of Your Business</b>	Sole proprietorship	No (%)	6(9)	3(38)	6(9)	17(26)	17(26)
	Family business		64(91)	5(62)	59(91)	48(74)	48(74)
	Partnership						
	Company						
	Other_____						
	<b>Total</b>			70(100)	8(100)	65(100)	65(100)
<b>8. Employment in Rice Production</b>	Farmer	No (%)	70(100)				
	Suppliers				65(100)		
	Millers			8(100)			
	Retailer					65(100)	
	Consumers						65(100)
	<b>Total</b>			70(100)	8(100)	65(100)	65(100)
<b>9. years of experience</b>	1year to 5 years	No (%)	5(7)		12(18)	2(3)	
	5years to 10years		8(12)	4(50)	24(37)	18(28)	
	10years to 15years		11(15)	1(13)	19(30)	22(34)	
	15years to 20years		46(66)	3(37)	10(15)	20(31)	
	above 20years					3(4)	
	<b>Total</b>			70(100)	8(100)	65(100)	65(100)
<b>10. Landholding size (acres/hectares)</b>	1 to 5 (acres/hectares)	No (%)	2(3)				
	5 to10(acres/hectares)		8(11)				
	10to15(acres/hectares)		5(7)				
	15to20(acres/hectares)		14(20)				
	20to25(acres/hectares)		11(16)				
	above25(acres/hectares)		30(43)				
	<b>Total</b>			70(100)			

Source: Field Survey, 2023

N =273, Farmer =70, Suppliers = 65, Millers = 8, Retailers = 65, Consumers=65

The study also found that 64 farmers (91%), 5 millers (62%), 59 suppliers (92%), 48 retailers (74%), and 48 customers (74%) owned family business partnerships. Farmers 70 (100%) and suppliers 65 (100%) were employed in rice production. Only 46 farmers (66%), 1 miller (13%), 10 suppliers (15%), 20 retailers (31%), and 11 customers (17%) have 15 years of experience in their field. According to the table, the maximum range of landholding size of farmers 30 (43%) showed above 25 acres/hectares, about 14 (20%) showed 15 to 20 acres/hectares and 11 (16%) showed 20 to 25 acres/hectares.

Table (4.2) shows the rice production supply chain is measured by nine factors. These are environmental factors, agricultural practices, input costs, market demand, government policies, technological advancement, infrastructure, socioeconomic factors, and average rice yield per acre (one acre).

The first part observes environmental factors such as drought, floods, extreme temperatures, and rainfall. Farmers 43 (62%), millers 6 (75%), suppliers 33 (51%), retailers 19 (29%), and customers 38 (58%) responded to the drought caused by environmental factors. Farmers 65 (93%), millers 6 (75%), suppliers 60 (92%), retailers 60 (92%), and customers 55 (85%) answered that flood. Farmers 39 (56%), millers 5 (62%), suppliers 47 (72%), retailers 11 (17%), and customers 45 (69%) said that extreme temperature. Farmers 50 (71%), millers 2 (25%), suppliers 11 (17%), retailers 11 (17%), and customers 11 (17%) answered that rainfall was caused by weather.

The second part is agricultural practices: quantity of seeds, farming techniques, pest control, and irrigation methods. Farmers 61 (87%), millers 7 (87%), suppliers 58 (89%), retailers 58 (89%), and customers 55 (85%) replied to the quantity of seeds caused by cultivation. Farmers 44 (63%), millers 7 (87%), suppliers 46 (71%), retailers 46 (71%), and customers 46 (71%) responded to farming techniques. Farmers 46 (66%), millers 6 (75%), suppliers 46 (71%), retailers 46 (71%), and customers 46 (71%) are supposed to have pest control. Farmers 22 (31%), millers 3 (37%), suppliers 19 (29%), retailers 19 (29%), and customers 26 (40%) answered that irrigation methods were caused by water. Farmers 46 (66%), millers 5 (63%), suppliers 42 (65%), retailers 42 (64%), and customers 40(60%) answered that use of fertilizers were caused by cultivation. Farmers 25(36%), millers 5 (63%), suppliers 35 (54%), retailers 35 (54%), and customers 35(54%) answered that use of herbicides were caused by cultivation. Farmers 46 (63%), millers 4 (50%), suppliers 29 (45%), retailers 29 (45%), and customers 29(45%) answered that use of herbicides were caused by cultivation.

The third part is an interview about input costs. It includes seeds, labor, machinery, and fertilizers. Farmers 27 (39%), millers 4 (50%), suppliers 16 (25%), retailers 16 (25%), and customers 5 (8%) answered the cost of seeds caused by farming. Farmers 26 (37%), millers 1 (12%), suppliers 29 (44%), retailers 20 (31%), and customers 30 (46%) replied to machinery. Farmers 17 (24%), millers 3 (37%), suppliers 20 (31%), retailers 29 (44%), and customers 30 (46%) responded to fertilizers.

The fourth part asked for a marked demand. Farmers 55 (79%), millers 8 (100%), suppliers 60 (92%), retailers 63 (97%), and customers 58 (89%) answered for market demand in the study area.

The fifth part reviews government policies. Government regulations, subsidies, trade policies, and import/export restrictions are asked. Farmers 9 (13%), millers 1 (12%), suppliers 4 (6%), retailers 4 (6%), and customers 3 (5%) responded to government regulations caused by agricultural policies. Farmers 49 (70%), millers 6 (75%), suppliers 59 (91%), retailers 57 (88%), and customers 60 (92%) answered to subsidies. Farmers 4 (11%) replied to import/export restrictions.

The sixth part is technological advancements: precision agriculture, vertical farming and hydroponics, climate-resilient farming practices, smart irrigation systems, and post-harvest technology are asked. Farmers 42(60%), millers 6 (75%), suppliers 34 (54%), retailers 35 (54%), and customers 44 (68%) responded to precision agricultures caused by technological advancements. Farmers 23(32%), millers 6 (75%), and customers 27 (41%) responded to vertical farming and hydroponics caused by technological advancements. Suppliers 51 (78%), retailers 50 (76%), and customers 45 (69%) responded to climate-resilient farming practices caused by technological advancements. Farmers 53(76%), millers 5 (63%), suppliers 36 (55%), retailers 42 (65%), and customers 36 (55%) responded to smart irrigation system caused by technological advancements. Farmers 42(60%), millers 4 (50%), suppliers 42 (65%), retailers 36 (55%), and customers 42 (65%) responded to post-harvest technology caused by technological advancements.

The seventh part is infrastructure. In this question, transportation, storage facilities, quality control, access to markets, and technology integration are asked. Farmers 57(81%), millers 6 (75%), suppliers 57 (88%), retailers 52 (80%), and customers 50 (77%) responded to transportations caused by infrastructure. Farmers 49(70%), millers 7 (87%), suppliers 46 (71%), retailers 43 (66%), and customers 46 (71%) responded to storage facilities caused by infrastructure. Farmers 45(64%),

millers 6 (75%), suppliers 46 (71%), retailers 40 (62%), and customers 36 (55%) responded to quality control caused by infrastructure. Farmers 50(71%), millers 3 (38%), suppliers 46 (69%), retailers 45 (71%), and customers 52 (80%) responded to access to markets caused by infrastructure. Farmers 33(47%), millers 4 (50%), suppliers 27 (41%), retailers 27 (41%), and customers 29 (45%) responded to technology integration caused by infrastructure.

The eight parts observe socioeconomic factors. The majority of the respondents answered that population growth, education and awareness, land distribution, and availability of socioeconomic conditions are asked. Farmers 42(60%), millers 4 (50%), suppliers 33 (51%), retailers 48 (74%), and customers 33 (51%) responded to population growth caused by socioeconomic factors. Farmers 27 (39%), millers 4 (50%), suppliers 42 (60%), retailers 25 (38%), and customers 45 (69%) responded to income level caused by socioeconomic factors. Farmers 56(80%), millers 6 (75%), suppliers 46 (86%), retailers 56 (86%), and customers 58 (89%) responded to education and awareness caused by socioeconomic factors. Farmers 38 (54%), millers 2 (25%), suppliers 33 (51%), retailers 38 (58%), and customers 36 (55%) responded to land distribution and availability caused by socioeconomic factors. Finally, farmers replied that the average rice yield per acre (one acre).

### 4.3.2 Measurement of the Rice Production Supply Chain in Respondents

**Table (4.2) Measurement of the Rice Production Supply Chain in Respondents**

No.	Particular		Farmer	Miller	Suppliers	Retailers	Consumers
1	<b>Environmental Factors</b>						
	Droughts (1,0),		43(62) 27(38)	6(75) 2(25)	33(51) 32(49)	19(29) 46(71)	38(59) 27(41)
	Floods (1,0),	(No)	65(93)	6(75)	60(92)	60(92)	55(85)
		(%)	5(7)	2(25)	5(8)	5(8)	10(15)
	Extreme temperatures (1,0)		39(56) 31(44)	5(62) 3(38)	47(72) 18(28)	11(17) 54(83)	45(69) 20(31)
	Rainfall (1,0),		50(71) 20(29)	2(25) 6(75)	11(17) 54(83)	11(17) 54(83)	11(17) 54(83)
Humidity (1,0),		43(61) 27(39)	3(12) 5(88)	44(66) 26(34)	34(52) 31(48)	34(52) 31(48)	

**Table (4.2) Measurement of the Rice Production Supply Chain in Respondents  
(Continued)**

No.	Particular		Farmer	Miller	Suppliers	Retailers	Consumers
<b>2. Agricultural Practices</b>	The quality of seeds (1,0),		61(87)	7(87)	58(89)	58(89)	55(85)
			9(13)	1(13)	7(11)	7(11)	10(15)
	Farming techniques (1,0),		44(63)	7(87)	46(71)	46(71)	46(71)
			26(37)	1(13)	19(29)	19(29)	19(29)
	Pest control (1,0),		46(66)	6(75)	46(71)	46(71)	46(71)
			24(34)	2(25)	19(29)	19(29)	19(29)
	Irrigation methods (1,0),	(No)	22(31)	3(37)	19(29)	19(29)	26(40)
		(%)	48(69)	5(63)	46(71)	45(71)	39(60)
Use of fertilizers (1,0),		46(66)	5(63)	42(65)	42(64)	40(61)	
		24(34)	3(37)	23(35)	23(36)	25(39)	
Herbicides (0,1,2,3)		25(36)	5(63)	35(54)	35(54)	35(54)	
		35(50)	3(37)	30(46)	30(46)	30(46)	
		5(7)					
		5(7)					
Pesticides (1,0),		46(63)	4(50)	29(45)	29(45)	29(45)	
		24(37)	4(50)	36(55)	36(55)	36(55)	
<b>3. Input Costs</b>	Seeds		27(39)	4(50)	16(25)	16(25)	5(8)
	labor						
	machinery	(No)	26(37)	1(13)	29(44)	20(31)	30(46)
	Fertilizers	(%)	17(24)	3(37)	20(31)	29(44)	30(46)
<b>4. Market Demand</b> <b>(1. Yes, 2. No)</b>	(No)		55(79)	8(100)	60(92)	63(97)	58(89)
	(%)		15(21)	0(0)	5(8)	2(3)	7(11)
<b>5. Government Policies</b>	Government regulations	(No)	9(13)	1(12)	4(6)	4(6)	3(5)
	Subsidies	(%)	49(70)	6(75)	59(91)	57(88)	60(92)
	Trade policies		8(6)	1(13)	2(3)	4(6)	2(3)
	Import/export restrictions		4(11)				

**Table (4.2) Measurement of the Rice Production Supply Chain in Respondents  
(Continued)**

<b>No.</b>	<b>Particular</b>		<b>Farmer</b>	<b>Miller</b>	<b>Suppliers</b>	<b>Retailers</b>	<b>Consumers</b>
<b>6.</b>	<b>Technological Advancements</b>		42(60)	6(75)	34(52)	35(54)	44(68)
	Precision Agriculture (1,0)		28(40)	2(25)	31(48)	30(46)	21(32)
	Vertical Farming and Hydroponics (1,0)		23(32) 47(68)	6(75) 2(25)			27(41) 38(59)
	Climate-Resilient farming practices (1,0)	(No) (%)			51(78) 14(22)	50(76) 15(24)	45(69) 20(31)
	Smart Irrigation Systems (1,0)		53(76) 17(24)	5(63) 3(37)	36(55) 29(45)	42(65) 23(35)	36(55) 29(45)
	Post-Harvest Technology (1,0)		42(60) 28(40)	4(50) 4(50)	42(65) 23(35)	36(55) 29(45)	42(65) 23(35)
	<b>7.</b>	<b>Infrastructure</b>					
Transportation			57(81) 13(19)	6(75) 2(25)	57(88) 8(12)	52(80) 13(20)	50(77) 15(23)
Storage Facilities			49(70) 21(30)	7(87) 1(13)	46(71) 19(29)	43(66) 22(34)	46(71) 19(29)
Quality Control		(No) (%)	45(64) 25(36)	6(75) 2(25)	46(71) 19(29)	40(62) 25(38)	36(55) 29(45)
Access to Markets			50(71) 20(29)	3(38) 5(62)	45(69) 20(31)	45(29) 20(71)	52(80) 13(20)
Technology Integration			33(47) 37(53)	4(50) 4(50)	27(41) 38(59)	27(41) 38(59)	29(45) 36(55)

**Table (4.2) Measurement of the Rice Production Supply Chain in Respondents  
(Continued)**

No.	Particular		Farmer	Miller	Suppliers	Retailers	Consumers
<b>8. Socioeconomic Factors</b>	Population Growth		42(60)	4(50)	33(51)	48(74)	33(51)
			28(40)	4(50)	32(49)	17(26)	32(49)
	Income Levels	(No)	27(39)	4(50)	42(60)	25(38)	45(69)
		(%)	43(61)	4(50)	28(40)	40(62)	20(31)
	Education and Awareness		56(80)	6(75)	56(86)	56(86)	58(89)
			14(20)	2(25)	9(14)	9(14)	7(11)
Land Distribution and Availability		38(54)	2(75)	33(51)	38(58)	36(55)	
		32(46)	6(25)	32(49)	27(42)	29(45)	
<b>9. Average rice yield per acre (one acre)</b>							
	2530 pound	(No)	41(72)				
	2464 pound	(%)	11(16)				
	2438 pound		8(6)				
	2484 pound		8(6)				

Source: Field Survey, 2023

N = 273, Farmer = 70, Suppliers = 65, Millers = 8, Retailers = 65, Consumers = 65

Table (4.2) shows the measurement of the rice production supply chain in respondents, including farmers, suppliers, millers, retailers and consumers, who are faced with situations of rice production.

The results of this survey are measured by eight factors: environmental factors, agricultural practices, input costs, market demand, government policies, technological advancements, infrastructure, and socioeconomic factors.

The environmental factors are more faced by farmers (68.6%), and retailers are least faced (41.4%). The agriculture practices are more faced by suppliers (92.4%) and farmers are least faced (82.4%). The input costs (seeds, machinery, fertilizers) are more faced by farmers.

The market demand is more faced by millers. All respondents expect more government subsidies. The technological advancements are more faced by consumers (59.6%) and farmers are least faced (45.6%). The infrastructures are more faced by



farmers (66.6%) and retailers are least faced (55.6%). The socioeconomic factors are more by consumers (52.8%) and millers are least faced (40%).

This results in the measurement of the rice production supply chain in all respondents yield of rice production for more output are needed from government subsidies. The government subsidies to farmers to pay for labor and material costs need to reduce borrowing costs.

#### **4.3.3 Challenges Faced by Respondents of Supply Chain in Rice Production in the Study Areas**

##### **(a) Challenges Faced by Farmers of Supply Chain in Rice Production in the Study Areas**

**Table (4.3) Challenges Faced by Farmers of Supply Chain in Rice Production in the Study Areas**

<b>No.</b>	<b>Particular</b>	<b>Respondents of Effect (No.)</b>	<b>Respondents of not Effect (No.)</b>	<b>Effect of Percent</b>	<b>Not Effect of Percent</b>
1.	Climate Change	60	10	86	14
2.	Lack of Infrastructure	60	10	86	14
3.	Land Degradation	39	31	56	44
4.	Labor Shortages	47	23	67	33
5.	Market Price Volatility	47	17	76	24
6.	Pests and Diseases	33	37	47	53
7.	Access to Finance	47	23	67	33
8.	Lack of Knowledge and Training	49	21	70	30

Source: Field Survey, 2023

N = 70, Farmers = 70

The challenges faced by farmers in the supply chain of rice production in the study areas are determined by eight factors. Farmers are faced by climate change (86%), lack of infrastructure (86%), land degradation (56%), labor storage (67%), market price

volatility (76%), pests and diseases (47%), access to finance (67%), and lack of knowledge and training (70%).

Farmers are more faced by climate change (86%) and an absence of infrastructure (86%). Farmers are least faced by pests and diseases (47%).

**(b) Challenges Faced by Suppliers in the Rice Production Supply Chain in the Study Areas**

Challenges faced by suppliers in the supply chain of rice production in the study areas are determined by eight factors. According to the Table (4.4), it shows that suppliers are affected by price volatility, quality control, infrastructure and logistics, competition, and changing consumer preferences. Environmental concerns, supply chain complexity, and regulatory compliance have not been affected.

**Table (4.4) Challenges Faced by Suppliers in the Rice Production Supply Chain in the Study Areas**

No.	Particular	Respondents of Effect (No.)	Respondents of not Effect (No.)	Effect of Percent	Not Effect of Percent
1.	Price Volatility	59	6	91	9
2.	Environmental Concerns	16	49	25	75
3.	Supply Chain Complexity	4	61	6	94
4.	Regulatory Compliance	12	53	18	82
5.	Quality Control	36	29	55	45
6.	Infrastructure and Logistics	41	24	63	40
7.	Competition	39	26	60	40
8.	Changing Consumer Preferences	36	29	55	45

Source: Field Survey, 2023

N = 65, Suppliers = 65

Suppliers are faced by price volatility (91%), environmental concerns (25%), supply chain complexity (6%), regulatory compliance (18%), quality control (55%), infrastructure and logistics (63%), competition (60%), and changing consumer preferences (55%).

Suppliers are more faced by price volatility (91%) and are least faced by supply chain complexity (6%).

**(c) Challenges Faced by Millers in the Rice Production Supply Chain in the Study Areas**

Ten factors were identified as challenges faced by millers in the supply chain of rice production in the study areas. According to Table (4.5), it found that environmental concerns, price fluctuations, technological advancements, raw material quality, consumer preferences, labor shortages, infrastructure, and regulatory compliance are affected, while market competition and processing efficiency are not.

**Table (4.5) Challenges Faced by Millers in the Rice Production Supply Chain in the Study Areas**

No.	Particular	Respondents of Effect (No.)	Respondents of not Effect (No.)	Effect of Percent	Not Effect of Percent
1	Environmental Concerns	4	4	50	50
2	Market Competition	8	0	100	0
3	Price Fluctuations	6	2	75	25
4	Technological Advancements	7	1	88	12
5	Raw Material Quality	8	0	100	0
6	Consumer Preferences	0	0	0	0
7	Labor Shortages	3	5	38	62
8	Processing Efficiency	0	8	0	100
9	Infrastructure	7	1	88	12
10	Regulatory Compliance	5	3	62	38

Source: Field Survey, 2023

N = 8, Millers = 8

Millers are faced by environmental concerns (50%), market competition (100%), price fluctuations (75%), technological advancements (88%), raw material quality (100%), consumer preferences (0%), labor shortages (38%), processing efficiency (0%), infrastructure (88), and regulatory compliance (62).

Millers are more faced by market competition (100%) and an absence of raw material quality (100%). Farmers are least faced by labor shortages (38%).

**(d) Challenges Faced by Retailers in the Rice Production Supply Chain in the Study Areas**

Challenges faced by retailers were identified as eight factors in the supply chain of rice production in the study areas. It shows that retailers have been affected by environmental concerns, the seasonal nature of rice cultivation, quality control, market access, and price fluctuations, while competition, political and economic stability, and technological adoption have not.

**Table (4.6) Challenges Faced by Retailers in the Rice Production Supply Chain in the Study Areas**

No.	Particular	Respondents of Effect (No.)	Respondents of not Effect (No.)	Effect of Percent	Not Effect of Percent
1.	Environmental Concerns	59	6	91	9
2.	Seasonal Nature of Rice Cultivation	58	7	89	11
3.	Competition	60	5	92	8
4.	Quality Control	34	31	52	48
5.	Market Access	63	2	97	3
6.	Political and Economic Stability	0	100	0	100
7.	Technological Adoption	2	63	3	97
8.	Price Fluctuations	47	18	72	28

Source: Field Survey, 2023

N = 65, Retailers = 65

Retailers are faced by environmental concerns (91%), seasonal nature of rice cultivation (89%), competition (92%), quality control (52%), market access (97%), political and economic stability (0%), technological adoption (3%) and price fluctuations (72%).

Retailers are more faced by market access (91%) and are least faced by technological adoption (3%).

**(e) Challenges Faced by Consumers in the Rice Production Supply Chain in the Study Areas**

Challenges faced by consumers were identified as seven factors in the supply chain of rice production in the study areas. In the Table (4.7), it shows that consumers have been affected by environmental impact, price fluctuations, and quality and safety concerns, while sustainability challenges, cultural erosion, supply chain transparency, and information asymmetry have not.

**Table (4.7) Challenges Faced by Consumers in the Rice Production Supply Chain in the Study Areas**

No.	Particular	Respondents of Effect (No.)	Respondents of not Effect (No.)	Effect of Percent	Not Effect of Percent
1	Environmental Impact	62	3	95	5
2	Price Fluctuations	59	6	91	9
3	Quality and Safety Concerns	53	12	82	18
4	Sustainability Challenges	0	65	0	100
5	Cultural Erosion	0	65	0	100
6	Supply Chain Transparency	0	65	0	100
7	Information Asymmetry	0	65	0	100

Source: Field Survey, 2023

N = 65, Consumers = 65

Consumers are faced by environmental impact (95%), price fluctuations (91%), quality and safety concerns (82%), sustainability challenges (0%), cultural erosion (0%), supply chain transparency (0%), and information asymmetry (0%).

Consumers are more faced by environmental impact (95%) and are least faced by quality and safety concerns (82%).

Table (4.8) shows issues related to the supply chain for farmers, suppliers, millers, retailers, and consumers.

**Table (4.8) Issues Related to the Supply Chain Issues Related to the Supply Chain**

No	Particular	Farmers (No.)	Suppliers (No.)	Millers (No.)	Retailers (No.)	Consumers (No.)
1.	Transportation	21	21	3	41	0
2.	Storage	26	26	5	24	0
3.	Access to markets	23	18			0

Source: Field Survey, 2023

N = 273, Farmer = 70, Suppliers = 65, Millers = 8, Retailers = 65, Consumers = 65

The issues related to the supply chain of rice production farmers are faced by transportation respondents (21 farmers), storage respondents (26 farmers), and access to markets respondents (23 farmers).

The issues related to the supply chain of rice production suppliers are faced by transportation respondents (21 suppliers), storage respondents (26 suppliers), and access to markets respondents (18 suppliers).

The issues related to the supply chain of rice production suppliers are faced by transportation respondents (3 millers) and storage respondents (5 millers).

The issues related to the supply chain of rice production suppliers are faced by transportation respondents (21 retailers) and storage respondents (26 retailers).

The issues related to the supply chain of rice production consumers are not faced by respondents.

The supply chain of rice production for farmers, suppliers, millers, and retailers faced a few issues, including not having enough storage areas. The second issue is difficult transportation. Farmers and suppliers faced difficulties accessing markets. The government needs to upgrade the roads and market efficiency. Farmers can take advantage of the opportunities of rice production.

(f) **Factors Affecting Rice Yield of the Selected Farm Household in Rice Production in the Study Area**

**Table (4.9) Factors Affecting Rice Yield of the Selected Household in Rice Production in the Study Area**

Model	Unstandardized Coefficients	Unstandardized Coefficients	Standardized	t	Sig.
	B	Std. Error	Beta		
1(Constant)	4.490*	2.510		1.789	.078
Education	-.370	.436	-.088	-.848	.400
Sown ace	-13.151	9.158	-.146	-1.436	.156
Labor	.336*	.169	.207	1.993	.051
Seed rate	1.137	.999	.119	1.139	.259
Access to Markets	.006	.541	.001	.010	.992
Access to Finance	1.802***	.527	.358	3.421	.001
Material cost	1.425**	.563	.267	2.532	.014
<b>R<sup>2</sup></b>		<b>0.60</b>			
<b>Adjusted R<sup>2</sup></b>		<b>0.57</b>			

Source: Field Survey, 2023

N = 70

(e) **Factors Affecting Rice Yield of the Selected Household Farmers in Rice Production in the Study Area**

This section indicated the estimate results of factors affecting the rice yield of the selected farm household of rice production in the study area. To determine the factors affecting the rice yield, multiple linear regression function was employed. The specific yield functions of rice farmers were estimated by using 8 independent variables; education, sown ace, labor, seed rate, access to markets, access to finance and material cost.

Table 4.9 showed the coefficient of dependent and independent variables of rice yield function. According to the rice yield estimates, the significant influencing factors of rice yield were labor, access to finance, and material cost. Rice yield was positively relationship with labor, access to finance, and material cost. Labor has positive

relationship with rice yield and it is significantly at 10% level. This means that if labor has increased by one unit, rice yield will increase by 0.336 units when other factors are held constant. Access to finance has a positive relationship with rice yield, and it is significantly at the 18% level. This means that if access to finance has increased by one unit, rice yield will increase by 1.802 units when other factors are held constant. Material cost has a positive relationship with rice yield, and it is significantly at the 14% level. This means that if access to finance has increased by one unit, rice yield will increase by 1.425 units when other factors are held constant. The result pointed out that the government and non-government organizations (NGOs) should provide access to finance and opportunities programs to the farmers in rice production. The result pointed out that the main challenges faced by farmers are labor, access to finance, and material costs.

The correlation coefficients are 0.60. The adjusted correlation coefficient of determination is 0.57, thus 57 percent of variation in rice yield by its independent variable (eight factors).



## **CHAPTER V**

### **CONCLUSION**

#### **5.1 Findings**

The study presents the rice production supply chain in Phyapon township, Ayeyarwady region. This stakeholder group included farmers, suppliers, millers, retailers, and consumers. The survey question's personal history summarizes the study area's rice production supply chain history. Socio-demographic characteristics of the respondents are shown as percentages of gender, age, education level, occupation, household size, household monthly income, type of business, employment in rice production, year of experience, and landholding size.

The result due to the measurement of the rice production supply chain is measured by nine factors. These are environmental factors, agricultural practices, input costs, market demand, government policies, technological advancement, infrastructure, socioeconomic factors, and average rice yield per acre (one acre). The result showed that environmental factors are drought, floods, extreme temperatures, and rainfall affected farmers and suppliers. The environmental factors are more faced by farmers (68.6%), and retailers are least faced (41.4%). Agricultural practices are quantity of seeds, farming techniques, pest control, and irrigation methods. The agriculture practices are more faced by suppliers (92.4%) and farmers are least faced (82.4%). Moreover, input costs, market demand, and government policies have affected all respondents. The input costs (seeds, machinery, fertilizers) are more faced by farmers. The market demand is more faced by millers.

The technological advancements are more faced by consumers (59.6%) and farmers are least faced (45.6%). The infrastructures are more faced by farmers (66.6%) and retailers are least faced (55.6%). However, farmers, suppliers, and retailers do not have access to markets and technology integration. The result found that the majority of the respondents have been affected by population growth, education and awareness, land distribution, and the availability of socioeconomic conditions. The socioeconomic factors are more by consumers (52.8%) and millers are least faced (40%).

Results due to challenges are faced by farmers, suppliers, millers, retailers, and customers in the supply chain of rice production. Farmers are more faced by climate change (86%) and an absence of infrastructure (86%). Farmers are least faced by pests and diseases (47%). Suppliers are more faced by price volatility (91%) and are least faced by supply chain complexity (6%). Millers are more faced by market competition (100%) and an absence of raw material quality (100%). Farmers are least faced by labor shortages (38%). Retailers are more faced by market access (91%) and are least faced by technological adoption (3%). Consumers are more faced by environmental impact (95%) and are least faced by quality and safety concerns (82%).

The supply chain of rice production for farmers, suppliers, millers, and retailers faced a few issues, including not having enough storage areas. The second issue is difficult transportation. Farmers and suppliers faced difficulties accessing markets. The government needs to upgrade the roads and market efficiency. Farmers can take advantage of the opportunities of rice production.

Farmers need to be promoted by the government and non-government organizations to support access to finance. The government needs to be supported by the yield of more rice production and the need to promote transportation. The government's support for the transportation of farmers can be reduced by transportation costs. Farmers faced with the need for workers and government supply to support the employment of workers can chain in these areas, which promotes rice production. Therefore, the government needs to support these regions by promoting labor and access to financing. The government's support to promote transportation in rice production reduces material costs and can increase the output of rice production.

## **5.2 Suggestions**

Identify the challenges and constraints faced by farmers and stakeholders in the rice supply chain. These may include weather-related issues, access to credit, infrastructure limitations, and market volatility. Rice production and supply chains in Phyapon Township, Ayeyarwady Region, Myanmar, face several challenges and constraints that impact the efficiency and sustainability of the sector. These challenges are often interconnected and can affect various aspects of rice cultivation, processing, distribution, and marketing.

Therefore, in order to overcome this, a particular need regarding awareness must be created in the study area. This awareness includes land availability and quality,

infrastructure and technology, access to credit and finance, market access and price fluctuations, land tenure and ownership, government policies and regulations, water management, labor shortages, quality control and certification, social and economic issues, and political stability.

Addressing these challenges and constraints in the rice production and supply chain in Phyapon Township and the Ayeyarwady Region would require a comprehensive approach involving government policies, investment in infrastructure, technology adoption, capacity building for farmers, and sustainable agricultural practices to ensure food security and economic development in the region.

## REFERENCES

- Ali, O., Verlinden, B., & Van Oudheusden, D. (2009). Infield logistics planning for crop-harvesting operations. *Engineering Optimization*, 41(2), 183-197.
- Banihashemi, S. A. (2011). Improving supply chain performance: The strategic integration of lean and agile supply chain. *African Journal of Business Management*, 5(17), 7557.
- Barungi, M., & Odokonyero, T. (2016). Understanding the rice value chain in Uganda-opportunities and challenges to increased production.
- Barungi, M., & Odokonyero, T. (2016). Understanding the rice value chain in Uganda-opportunities and challenges to increased production.
- Brown, C., & Miller, S. (2008). The impacts of local markets: A review of research on farmers markets and community supported agriculture (CSA). *American journal of agricultural economics*, 90(5), 1296-1302.
- Canavari, M., & Darnhofer, I. (2012). Export Conditions of Myanmar Mango: Hindrances and Opportunities in the Supply Chain.
- Chen, I. J., & Paulraj, A. (2004). Understanding supply chain management: critical research and a theoretical framework. *International Journal of production research*, 42(1), 131-163.
- Conway, G. R., & Barbie, E. B. (1988). After the green revolution: sustainable and equitable agricultural development. *Futures*, 20(6), 651-670.
- Felea, M., & Albăstroi, I. (2013). Defining the concept of supply chain management and its relevance to romanian academics and practitioners. *Amfiteatru Economic Journal*, 15(33), 74-88.
- Felea, M., & Albăstroi, I. (2013). Defining the concept of supply chain management and its relevance to romanian academics and practitioners. *Amfiteatru Economic Journal*, 15(33), 74-88.
- Halder, P., & Pati, S. (2011). A need for paradigm shift to improve supply chain management of fruits & vegetables in India. *Asian Journal of Agriculture and Rural Development*, 1(393-2016-23908), 1-20.

- Htun, H. H. (2013). *Supply chain management of groundnut production in Magway Township* (Doctoral dissertation, Yezin Agricultural University).
- Kassa, B. (2010). *Rice value chain in Metema District, North Gondar, Ethiopia: Challenges and opportunities for innovation* (Doctoral dissertation, Addis Ababa University).
- Khush, G. S. (2005). What it will take to feed 5.0 billion rice consumers in 2030. *Plant molecular biology*, 59, 1-6.
- Kumar, V., Kumar, V., Kumar, A., Kochewad, S., & Singh, M. (2017). Marketing channels, marketing cost, margin and producer's share in consumer's rupee in paddy marketing. *Agro-Economist*, 4(1), 21-27.
- Lei, S. Y. W. (2016). *Assessment on Cabbage and Cauliflower supply chain management in Kalaw Township, Southern Shan State* (Doctoral dissertation, MERAL Portal).
- Markelova, H., Meinzen-Dick, R., Hellin, J., & Dohrn, S. (2009). Collective action for smallholder market access. *Food policy*, 34(1), 1-7.
- Min, S., Zacharia, Z. G., & Smith, C. D. (2019). Defining supply chain management: in the past, present, and future. *Journal of business logistics*, 40(1), 44-55.
- Nagurney, A. (2006). *Supply chain network economics: dynamics of prices, flows and profits*. Edward Elgar Publishing.
- Parwez, S. (2014). Food supply chain management in Indian Agriculture: Issues, opportunities and further research. *African Journal of Business Management*, 8(14), 572.
- Pettersson, A. I., & Segerstedt, A. (2013). Measuring supply chain cost. *International Journal of Production Economics*, 143(2), 357-363.
- Rath, B., Wonginta, T., & Amchang, C. (2022). Risk analysis of the rice supply chain in Cambodia. *Journal of International Logistics and Trade*, 20(2), 58-77.
- Shang, K. C., Lu, C. S., & Li, S. (2010). A taxonomy of green supply chain management capability among electronics-related manufacturing firms in Taiwan. *Journal of environmental management*, 91(5), 1218-1226.
- Soe, J. (2015). *Fertilizer supply chain and market structure: A case study in Tatkon Township, Nay Pyi Taw* (Doctoral dissertation, Yezin Agricultural University).

- Soe, T. Y. (2015). *Study on Supply Chain of the Selected Vegetables in Mon State* (Doctoral dissertation, MERAL Portal).
- Soto-Silva, W. E., Nadal-Roig, E., González-Araya, M. C., & Pla-Aragones, L. M. (2016). Operational research models applied to the fresh fruit supply chain. *European Journal of Operational Research*, 251(2), 345-355.
- Sukati, I., Hamid, A. B., Baharun, R., & Yusoff, R. M. (2012). The study of supply chain management strategy and practices on supply chain performance. *Procedia-Social and Behavioral Sciences*, 40, 225-233.
- Thomas, D. J., & Griffin, P. M. (1996). Coordinated supply chain management. *European journal of operational research*, 94(1), 1-15.
- Thwin, N. K. S., Takahashi, K., & Maeda, K. (2016). The activities of rice specialized companies in the supply chain of rice in Myanmar.
- Totin, E., Van Mierlo, B., Saïdou, A., Mongbo, R., Agbossou, E., Stroosnijder, L., & Leeuwis, C. (2012). Barriers and opportunities for innovation in rice production in the inland valleys of Benin. *NJAS-Wageningen Journal of Life Sciences*, 60, 57-66.
- Van der Vorst, J. G. (2004). Supply Chain Management: theory and practices. In *Bridging Theory and Practice* (pp. 105-128). Reed Business.
- Van Nguyen, N., & Ferrero, A. (2006). Meeting the challenges of global rice production. *Paddy and Water Environment*, 4, 1-9.
- Wang, M., & Zhang, K. (2022). Improving Agricultural Green Supply Chain Management by a Novel Integrated Fuzzy-Delphi and Grey-WINGS Model. *Agriculture*, 12(10), 1512.
- Williams, G. J. (2021). Developing a Fairtrade rice supply chain from Myanmar: achievements, challenges, lessons. *Journal of Fair Trade*.
- Zokaei, A. K., & Simons, D. W. (2006). Value chain analysis in consumer focus improvement: a case study of the UK red meat industry. *The International Journal of Logistics Management*, 17(2), 141-162.
- Zokaei, K., & Hines, P. (2007). Achieving consumer focus in supply chains. *International Journal of Physical Distribution & Logistics Management*, 37(3), 223-247.

## Socio-economic Condition

### General Information

a. Gender Male  Female

b. Age \_\_\_\_\_ years

c. Education Primary  Secondary  University   
Master and above

d. Occupation Government Sector  Private Employee   
Self-Owned Business  Informal Sector   
Others

### e. Household Information

Household Size 1 to 3  3 to 5   
5 to 8  Above 8

### f. Household Monthly Income

Less than Ks 200,000 Ks  200,001 – 400,000Ks   
400,001 – 600,000 Ks  600,001 – 800,000Ks   
Above 800,000ks

### g. Type of Your Business

Sole proprietorship  Family business   
Partnership  Company  Other \_\_\_\_\_

### h. Employment in Rice Production:

a. What is your role in the rice production supply chain?

Farmer  Farm laborer  Mill operator   
Trader  Other (please specify)

b. How many years of experience do you have in your current role?

1year to 5 years  5years to 10years   
10years to 15years  15years to 20years   
above 20years

10. Average rice yield per acre (one acre) -----

## Part-II

### 2. Farmers

#### a. Landholding size (acres/hectares)

- 1 to 5 (acres/hectares)  5 to 10 (acres/hectares)   
10 to 15(acres/hectares)  15 to 20 (acres/hectares)   
20 to 25 (acres/hectares)  above 25 (acres/hectares)

#### b. Type of rice cultivation

- Traditional  Hybrid  Organic

#### c. What rice varieties do you grow?

- Pawsanyin  Pawsangyi  Sinthawlat   
Yatkoesel  Kyautnyeain  Ngasein   
Nyeankhar

#### d. Main Source of Labor

- Family  Local   
Out of the township  Out of the Region

#### e. Main Source of Finance

- Own Financing  Family   
Friends and Related  Formal Financial Institutions   
Microfinance group  Informal Financial market

#### f. What are the main challenges you face in rice production? (Any three or five can choice)

Climate Change <input type="checkbox"/>	Lack of Infrastructure <input type="checkbox"/>
Land Degradation <input type="checkbox"/>	Value Chain Inefficiencies <input type="checkbox"/>
Labor Shortages <input type="checkbox"/>	Quality Standards <input type="checkbox"/>
Market Price Volatility <input type="checkbox"/>	Changing Consumer Preferences <input type="checkbox"/>
Pests and Diseases <input type="checkbox"/>	Logistical Challenges <input type="checkbox"/>
Access to Finance <input type="checkbox"/>	Competition and Market Saturation <input type="checkbox"/>
Lack of Knowledge and Training <input type="checkbox"/>	Technological Barriers <input type="checkbox"/>



**g. Issues related to the supply chain**

transportation  storage  access to markets

**Part-III**

**3. Suppliers:**

**a. Market and Pricing: How is the rice sold in the market?**

Sell to local markets <input type="checkbox"/>	Sell to value added producers <input type="checkbox"/>
Sell to intermediaries <input type="checkbox"/>	Direct Selling to consumer at owner shop <input type="checkbox"/>
Sell to rice wholesalers <input type="checkbox"/>	Direct Selling to consumer online <input type="checkbox"/>
Sell to rice collector <input type="checkbox"/>	Sell to exporters <input type="checkbox"/>
Sell to rice retailers (Venders) <input type="checkbox"/>	Others _____ <input type="checkbox"/>

**b. Source of access market information**

From friend and relatives <input type="checkbox"/>	From printed media <input type="checkbox"/>
From market <input type="checkbox"/>	From social media <input type="checkbox"/>
From broadcasting media <input type="checkbox"/>	Other sources <input type="checkbox"/>

**c. Market Access and Transportation: How do you transport your rice products to the market?**

Road  River  Rail

**d. Marketing and Sales a. Who are your primary customers?**

Wholesalers  Retailers  Exporters

**e. How do you market and sell your rice products?**

local markets  export  online platforms   
Others \_\_\_\_\_

**f. Marketing channels of your product (Domestic market) through**

Direct Selling  Collectors  Wholesalers   
Retailers  Others \_\_\_\_\_

**g. Marketing channels of export market through**

Direct Selling  Collectors  Wholesalers   
Retailers  Others \_\_\_\_\_

**h. What are the main challenges you face in rice production? (Any three or five can choose)**

Price Volatility <input type="checkbox"/>	Environmental Concerns <input type="checkbox"/>
Supply Chain Complexity <input type="checkbox"/>	Regulatory Compliance <input type="checkbox"/>
Quality Control <input type="checkbox"/>	Infrastructure and Logistics <input type="checkbox"/>
Competition <input type="checkbox"/>	Changing Consumer Preferences <input type="checkbox"/>

**i. Issues related to the supply chain**

Transportation       Storage       Access to markets

#### Part-IV

**4. Millers**

**a. How many rice mills do you operate in the area?**

1       2       3       4   
 5       6       7       8

**c. How do you maintain the quality of rice during the milling process? (Any two or four can choose)**

Proper Cleaning <input type="checkbox"/>	Bran Removal Control <input type="checkbox"/>
Optimal Moisture Content <input type="checkbox"/>	Proper Milling Equipment <input type="checkbox"/>
Packaging and Storage <input type="checkbox"/>	

**d. How do you handle and store the processed rice to maintain its quality? (Any one or three can choose)**

Temperature <input type="checkbox"/>	Moisture Control <input type="checkbox"/>
Cool, Dry, and Dark Place <input type="checkbox"/>	Avoid Strong Odors <input type="checkbox"/>
Pest Control <input type="checkbox"/>	

**e. What are the main challenges you face in rice production? (Any three or five can choose)**

Environmental Concerns <input type="checkbox"/>	Market Competition <input type="checkbox"/>
Price Fluctuations <input type="checkbox"/>	Technological Advancements <input type="checkbox"/>
Raw Material Quality <input type="checkbox"/>	Consumer Preferences <input type="checkbox"/>
Labor Shortages <input type="checkbox"/>	Processing Efficiency <input type="checkbox"/>
Infrastructure <input type="checkbox"/>	Regulatory Compliance <input type="checkbox"/>

**f. Issues related to the supply chain**

Transportation       Storage       Access to markets

**Part-V**

**5. Retailers**

**a. What are the criteria you consider when selecting rice for retail or export? (Any two or four can choose)**

Grain Quality and Appearance <input type="checkbox"/>	Moisture Content <input type="checkbox"/>
Grain Type and Variety <input type="checkbox"/>	Pricing and Market Demand <input type="checkbox"/>
Aroma and Taste <input type="checkbox"/>	Milling Degree <input type="checkbox"/>
Packaging <input type="checkbox"/>	

**b. Have you noticed any changes in consumer preferences regarding rice quality? (Any two or four can choose)**

Organic and Sustainable Options <input type="checkbox"/>	Packaging and Presentation <input type="checkbox"/>
Health and Nutrition <input type="checkbox"/>	Texture and Taste <input type="checkbox"/>
Specialty Rice Varieties <input type="checkbox"/>	Price and Value <input type="checkbox"/>

**c. What are the challenges you face in marketing rice, especially with respect to quality and yield? (Any three or five can choose)**

Environmental Concerns <input type="checkbox"/>	Regulations and Standards <input type="checkbox"/>
Seasonal Nature of Rice Cultivation <input type="checkbox"/>	Competition <input type="checkbox"/>
Quality Control <input type="checkbox"/>	Infrastructure and Logistics <input type="checkbox"/>
Market Access <input type="checkbox"/>	Political and Economic Stability <input type="checkbox"/>
Technological Adoption <input type="checkbox"/>	Supply Chain Complexity <input type="checkbox"/>
Price Fluctuations <input type="checkbox"/>	

**d. Issues related to the supply chain**

Transportation       Storage       Access to markets

## Part-VI

### 6. Consumers

a. What are the factors influencing your choice of rice for consumption? (Any two or four can choice)

Environmental Concerns <input type="checkbox"/>	Texture and Cooking Outcome <input type="checkbox"/>
Nutritional Content <input type="checkbox"/>	Price and Affordability <input type="checkbox"/>
Culinary Preferences and Taste <input type="checkbox"/>	Cooking Convenience and Time <input type="checkbox"/>

b. How important is rice quality to you, and how do you define it? (Any one or three can choice)

Grain Appearance <input type="checkbox"/>	Price <input type="checkbox"/>
Texture <input type="checkbox"/>	Nutritional Value <input type="checkbox"/>
Taste <input type="checkbox"/>	

c. Are you willing to pay a premium for higher-quality rice?

Yes

No

d. Are you aware of any challenges or constraints related to rice production in the region?

(Any two or four can choice)

Environmental Impact <input type="checkbox"/>	Price Fluctuations <input type="checkbox"/>
Quality and Safety Concerns <input type="checkbox"/>	Sustainability Challenges <input type="checkbox"/>
Cultural Erosion <input type="checkbox"/>	Supply Chain Transparency <input type="checkbox"/>
Information Asymmetry <input type="checkbox"/>	

## VII

### 7. Environmental Factors

Variables like weather conditions, climate patterns, and natural disasters can significantly impact rice production. (Any two or four can choice)

Droughts <input type="checkbox"/>	rainfall <input type="checkbox"/>
Floods <input type="checkbox"/>	humidity <input type="checkbox"/>
Extreme temperatures <input type="checkbox"/>	

### 8. Agricultural Practices (Any two or four can choice)

Factors to related can influence rice production efficiency and output.

the quality of seeds <input type="checkbox"/>	Farming techniques <input type="checkbox"/>
Pest control <input type="checkbox"/>	Irrigation methods <input type="checkbox"/>
Use of fertilizers <input type="checkbox"/>	Herbicides <input type="checkbox"/>
Pesticides <input type="checkbox"/>	Other <input type="checkbox"/>

### 9. Input Costs

The cost and availability of inputs can affect the level of rice production.

Seeds  labor  machinery

Fertilizers

### 10. Market Demand

The demand for rice in the market can drive production levels. If there's a higher demand for rice, producers might increase their output to meet it.

Yes  No

### 11. Government Policies

A significant impact on rice production,

Government regulations  Subsidies

Trade policies  Import/export restrictions

### 12. Technological Advancements (Any two or four can choice)

Technological Advancements: Innovations in agricultural technology can lead to increased productivity and efficiency in rice production.

Precision Agriculture <input type="checkbox"/>	Vertical Farming and Hydroponics <input type="checkbox"/>
Climate-Resilient farming practices <input type="checkbox"/>	Smart Irrigation Systems <input type="checkbox"/>
Post-Harvest Technology <input type="checkbox"/>	

### 13. Infrastructure (Any two or four can choice)

Adequate transportation, storage facilities, and access to markets play a crucial role in the rice supply chain.

Transportation <input type="checkbox"/>	Storage Facilities <input type="checkbox"/>
Quality Control <input type="checkbox"/>	Access to Markets <input type="checkbox"/>
Technology Integration <input type="checkbox"/>	

**14. Socioeconomic Factors (Any two or four can choice)**

**The socio-economic conditions of the regions where rice is produced can influence production levels. Factors like income levels, population growth, and land distribution can all have an impact.**

Climate and Environmental Factors <input type="checkbox"/>	Population Growth <input type="checkbox"/>
Income Levels <input type="checkbox"/>	Education and Awareness <input type="checkbox"/>
Land Distribution and Availability <input type="checkbox"/>	Technological Advancements <input type="checkbox"/>

## Map of the Study Area (Phyapon Township)

