

**PPITT MODEL ; The Agricultural Business Solution for Sustainable
Agriculture in the Future for Thailand
(Public Private Innovation Team Thailand, Ppitt)
Supported to Thai Government Policy Thailand 4.0**

Chayapol Khatikarn (A'Joe Khatikarn)
Experts and Senior Consultant
Management of Small and Medium - Sized Enterprises
Innovation and Technology, Agriculture, Energy Engineering and Environment

ABSTRAK

One of the ongoing agriculture problems in Thailand is the monopoly and pressure from creditors to farmers. In this study, the author would like to propose the solution of this issue by suggesting several strategies. Firstly, local farmers have to form a cluster originating from a small group or community that can support knowledge exchange and sharing. Apart from this, we need to engage the use of technology for large scale farming as it has always been practiced in the European countries for the sake of efficiency. All of these knowledge has been imported to Thailand as a tool for improvement, and it will also support the concept of Thailand 4.0, which is backed by the concept of modern agriculture that is inspired by the royal project of Thailand's King. In summary, these strategies will help Thai farmers to evolve as "Smart Farmers" (reduce cost and increase quality yields) that are equipped with "Precision Farming" tool.

Introduction

At this present, the Thai government is working hard to promote " Thailand 4.0 " as a new gimmick and economic model aimed at pulling Thailand out of the middle-income trap and push the country in the high-income range. If you don't know what is "Thailand 4.0" don't blame yourself. A survey by the Centre for Economic and Business Forecasting showed that slightly more than half of the businesses in Thailand knew little about Thailand 4.0 when asked to rate their understanding on Thailand 4.0 , 55% admitted they had little knowledge about it and only 1% responded that they knew it in between , 27% of the respondents said they somewhat knew what it meant and 17% said they knew it pretty well.

Why Thailand 4.0

In the first model, " Thailand 1.0," emphasis was placed on the agricultural sector. The second model, " Thailand 2.0, " focused on light industries, which helped upgrade the country's economy from the low-income to middle-income status. In the third model, " Thailand 3.0, " the country is currently emphasizing heavy industries for continued economic growth. During this period, Thailand has become stuck in the middle-income trap and faces disparities and imbalanced development.

What is the middle-income trap

The " middle-income trap, " is a situation in which a country's growth slows after having reached the middle-income levels. Middle-income countries like Thailand are squeezed between their low-wage competitors that dominate the mature industries on one side. And the rich-country innovators that dominate industries of rapid technological change on the other side.

In other words, Thailand is moving on from a country with abundant cheap, unskilled labor to an innovation " value-based economy " to climb to the next step of the ladder.

Thailand 4.0, towards a value-based economy

Thailand 4.0 focuses on a " value-based economy. " as the country needs to deal effectively with disparities and the imbalance between the environment and society. Prime Minister General Prayut Chan-o-cha explained that Thailand 4.0 has three elements, which mark a significant change in the country's economy and production Become a high-income nation

The first element aims to enhance the country's standing to become a high-income nation through developing it as a knowledge-bases economy. With an emphasis on research and development, science and technology, creative thinking, and innovation. Move toward an inclusive society

In the second element, Thailand will move toward an " inclusive society " with equitable access to the fruits of prosperity and development. Focus on a sustainable growth and development The third element focuses on " sustainable growth and development, " in order to achieve economic growth and sustainable development without destroying the environment. " less for more " vs " more for less . "The Thailand

new model will change the country's traditional farming to smart farming. Traditional SMEs to smart enterprises, and traditional service to high-value service, under the concept of " less for more " rather than " more for less "

Currently situation, Thai agriculture Lack of real literacy skills in cropping including lack of human labor, make farming is not good yield. In addition to the lack of appropriate using also . Without good management knowledge, the cost of production would increase. And the price of agricultural products is falling due to supply over demand and products substitution in the world market Precision farming is suitable for agriculture today. To reduce costs 20% and 20% increase in productivity according to government policy. This initiative was initiated. The concept is innovative.

The service model is unique and covers every step of the farming process.

- 1) Soil preparation step
- 2) Planting process
- 3) Maintenance procedure
- 4) Harvesting process

Service innovation Fully integrated in this format can apply for patent registration.

1. Service style Complete This can reduce the cost of increasing productivity of cassava. Which will cover The

technology of cassava production is 6 steps.

- 1) Selective breeding
- 2) Soil improvement
- 3) Use of fertilizers (organic / chemical)
- 4) Water management
- 5) Plant protection
- 6) Suitable machinery and peripherals.

2. Service style It can be seen in the training of customers has created a new dimension. In agriculture Let the

younger generation love to work in agriculture more.

Key Success direction and policy of PPITT model

To create PPITT model concept we have to get the correct information, analyses and evaluation to set up concrete direction to do implementation efficiency and productively. Short-term the success period, we come up with PPITT model direction and the policy of Ministry of Agriculture and Cooperatives for 10 long-term plans as follows: Why Thai agricultural has problems ? and What is the solution advised by Public Private Innovation Team Thailand, PPITT

1. Consideration of a high-price crop value and improve to product processing to serve marketing new channels. It can be increased the value of agricultural output. (Agri. Map)
2. Improve soil maintenance with organic matter with Crop Selection and Crop Rotation
3. Basic farmers need to have knowledge and research more consistently by access data then turn to be Smart Farmer.
4. They should be a network (Cluster) to exchange knowledge, experience and work together closely. Create a proud of professional farmer is needed.
5. Precision Farming to reduce costs, increase productivity, increase income by choosing Appropriate Technology (searching for knowledge resources) Mr. Teerapat Prayoonthi : Permanent Secretary, Ministry of Agriculture and Cooperatives address an overview of 10 long-term plans as follows :

1. Encourage farmers to get easily access information.
2. Increase the production capacity of agricultural products sufficient for domestic consumption
3. Innovate and develop innovative technologies.
4. Fix the debt problem of farmer.
5. Develop and improve existing law and regulation.
6. Focus on making large livestock focus on healthy meat product.
7. Value added to agricultural products.
8. Adapt production in line with climate change.
9. Focus on research and development.
10. Integrate collaboration across all relevant ministries to cover every

dimension.

Considering the above key statements PPITT will be able to start its strategic planning which is the most of key success management tool as follow the concept of the model of agriculture business solution.

PPITT Model Methods: Strategic planning to meet the sustainable agriculture.

SWOT analysis

Strength; S

1. PPITT, There are professional personnel who are experienced in all sectors including education, government, Farmer ect.

2. Thai Farmers, Thai Agricultural Machinery Group And Thai Agricultural Industry group has a love of understanding in agriculture for long time which is the basis of the agricultural culture of the Thai people.
3. Farmers is the basic foundation of a nation that is well equipped with all the elements that are easy to develop Continuously.
4. Governments focus on short-term policies to long term always promote. agricultural development in all dimensions as the nation agenda then deploy their policy through every operation in all ministries
5. Thai Agro-Industry Thai Farmers and Thai Industry know how have an accepted by CLMV. It has the knowledge, ability and experience as a leading firm in agriculture business.
6. Thai farmers and Thai entrepreneurs have a habit of cooperating with their neighbors, honor each other, fair, honest, do not cheat on partnership or joint ventures in comparison with others nation.

Weakness; W

1. Most Thai farmers has long-term and chronic systemic and long-term liabilities.
2. The value of agricultural products, the economic downturn is unstable with the global supply and demand due to agricultural competitor in the world.
3. First generation Thai farmers still attached to the old fashion agriculture process with very old age in average age 56 years old. The environment has changed a lot such as soil fertility, agricultural water and irrigation, changing social conditions together between Western and Eastern civilization combination which effect to culture.
4. Thai grandparents and parents are getting older will be impacted on technological development and the right innovation include restrictions. The transfer of knowledge into practice rapidly and timely change of region or of the world.
5. The descendants of most farmers do not grow inheritance of agriculture because of the economic and social conditions. Household microeconomics is unfavorable or stimulate the consciousness to love agriculture as in the past. Especially the problem the family's economic problems are debt or high earning opportunities.
6. Big farm area or agriculture area is not belong to the farmer because of being taken over by borrowers, mortgage loans. Farmers changed status as employee Instead of owning also the ground was lack of fertility, deterioration from a long time without maintenance.
7. Agricultural machinery industry in Thailand did not have knowhow to do large engine (Engine: Tractor) It means that we cannot think of our self as an innovator in information technology in Precision Farming.
8. Farmers involved in related industries and all contributors lacked network integration. It is reliable and there is no perfect synergy effect throughout the supply chain (into Team work).
9. Thai farmers and entrepreneurs are also adhering to the principle of subsidizing money. They always bargain to get money for free or no interest instead of building knowledge and bring experience to get money or strengthen the sustainably wealthy career.
10. Thai farmers lack knowledge and experience in mechanical access and modern equipment and systems. Cutting edge technology is expensive and needs to be updated then deployment in Thailand is corrected.
11. Thai farmers are still lack of knowledge, understanding and implementing so often they get a very poor quality of production factor such as fertilizer according to propaganda and the exaggerated benefits from the unfair service providers. (some MLM systems)

Opportunity; O

1. The government reforms its agricultural policy supports and promotes all forms of agriculture. Ever wrong in the past adjusted to the mainstream policy. It is a national agenda to understand and access to and solve the problems of agricultural development in the country.
2. Thailand has a good image (Brand Image & Leader) as a leader in many variety of business such as consumer goods, vehicles and parts. Entertainment business in the CLMV.
3. Thailand has favourable terrain and geography for agriculture in CLMV. There are also same culture and basic similar traditions in the region.
4. Domestic agriculture is diversified to combining all forms of monoculture and agriculture combines the size of a household, a community, an agricultural industry in every dimension, such as a crop, a garden, an ornamental tree, a cow, a cow, a fish, a fish, etc.
5. Thailand is ready and the opportunity to be business centres of the US and Europe. The main factors that contribute to the investment security, safety and prosperity.

Threats; T

1. Economic crops of Thailand in the past were dropped and the country's revenue has been falling. There are cheap and good CLMV rivals so we are suffering from all kinds of crops such as rice, cassava, rubber, etc.
2. The investment of large agricultural technology leaders both America and Europe are beginning to invest in more and more home for both quantity and quality. Opportunities will cause problems in the country's competitiveness.
3. Water management, irrigation and climate are problems of forecasting more difficult, not seasonal compare to the past which directly affecting agriculture, productivity, quality and agricultural efficiency.
4. Big ground or big farms are not belong to the farmers that may not be fully utilized or contrary to the expected large-scale farming operations aim to get out come to increase productivity by 20%, reduce costs by 20%, and have a residual income for the farmers.
5. CLMV's neighbouring agricultural areas are largely governmental owned so easy to promote development with unity. The area is much more fertile than in Thailand and also getting technology from America or Europe is easier and get the achievement faster results.

Vision

PPITT is the leading firm on Agriculture business management solution to develop our country in Economical, Sociability and Environmental according to government policy by focusing on strengthen sustainable agriculture with appropriate technology transfer as the solution.

Mission

To strengthen and development of PPITT's model need to be effective and effectiveness according to the intent of the members. So the mission of them is as follows.

1. To create the consulting center related to Precision Farming in the area of technology and innovation, fully integrated with the experts who have an expertise in every field from all sectors to maximize potential in service comprehensive introduction including opportunities to produce joint research. It creates new innovations taking into account the optimization of management and development throughout the supply chain and focus on the higher value chain creation
2. Support, develop, promote on modern farming technology and precision farming by Smart Farmer will increase productivity, reduce costs for agricultural production. Develop the knowledge of farmers who will be Smart Farmer to create opportunities for sustainable income, sustainable wealth and good quality of life.
3. Support the research results. development of machine tools, peripherals and applications with information technology aimed to commercialization opportunities at all levels of households, communities, provinces and countries.
4. Commit to using information technology and modern technology then manage both the efficient database storage and application of appropriate applications in modern agriculture and disseminate information in the Call Center/ Assistant Call Center to members who interested.
5. Perform integrated management, create a new performance of network, such as Network, Cluster, Supply Chain, Alliance, or MOU.
6. Commit to the development all activities in line with the Government of Thailand 4.0 policy, Publish Private cooperation and Developing big plantation related to our main policy and business strategy to formulate Thai Team.
7. Be aware of the environmental protection of the country and the world using Green Technology and Organic Agriculture for the abundance of resources to the next generation.

Objective: 5 Yrs.

1. Encouraging integration of buying innovation and modern technology in products, production and service.
2. Promoting product integration with service high quality, reasonable price and delivery consistent to customer requirements.
3. The development and promotion of a modern integrated management model namely cluster Integrated to business & Supply Chain management.(Integrated Execution & Continuous)
4. Development and promotion of membership to continue Learning and practicing whole life.
5. Public Relations expand network to secure lasting prosperity.

Target: Yr. 2017

1. Utilizing the knowledge, ability and experience of the members join to test and share innovation on selected of appropriate technology consistent with the production of goods and services according to customer needs.
2. Production Planning Management and services that correspond to production and marketing plans for customers with strictly concerned of product quality, service partnerships, fair price and right time delivery as a same team work.

3. Strengthening integration and link business elements in both verticals and horizontals in clustered landscape for increase the higher value of efficiency and effectiveness of all sectors.
4. Continuously allocating and developing personnel in every cluster members to do research and development in their business by means of Production, sales / marketing, information technology services, business, secretarial and human resources development. Upgrade the knowledge base to raise the level of business people to meet the international economy requirement.
5. Strengthen public relations innovation in all levels communicate direct to the target audience (Below the line), Use of technology media modern communications FB, Website, IG, Line etc.(On the Line) and indirect one-way communication is Poser Bill Board (Above the Line) Including the collection of subscriber databases and customer support for communication in the Assistance Call Center provide access to up-to-date information for decision making purposes.

Defining Marketing Strategies and Sale of PPITT model

Product

There are research projects related to the development of relevant technology methodologies and experiment business process with various prototypes in both small and large plots.

Price

Determine the price of this new business model by comparing the cost of production compared to the new method It is a value-based price that is comparable to the yield per ton. For mutual benefit (win-win)

Place

Based on the channel from the existing customer contact by selection of location, size and availability of investment by doing clustered group activities.

Promotion

Start by demonstrating the effects of the new management model and then use it as a demo case for future clients along with road shows and seminars to convey concepts and business models. New agriculture. Therefore our PPITT model service to the customers is the solution of precision farming by consulting to build smart famers.

PPITT Model; The agriculture business solution by Precision Farming

Sustainability in agriculture is increasing in importance as the World issues is impacted by rising production costs, fluctuating product costs and/or prices and food security safety requirements, as well as customer demand for better quality/ healthier products, Meeting this challenge requires farming enterprises to cut costs, increase production maintain product quality and become more effective, though this task is impossible without the innovation aspects thus PPITT Model is the one concept to fix and fit with above.

The key element of the precision farming for this project is

- Knowledge of the project. It is based on research, experimentation and compilation of experts.
- Mechanical equipment Agriculture from domestic producers or develop from foreign Technology.
- Aerospace technology and information from overseas development.

How to Stepping into Agriculture 4.0

Precision Farming

It is an environmentally friendly farming strategy. Farmers can adjust the use of resources in accordance with the condition of the farm area including effective and accurate care of environment.

Key factor :

1. Information (Big Data on the Farm activities to support decision making)
2. Technology
 3. Management

Benefit of Precision Farming

1. Lower cost
2. High Productivity, High Quantity, High Quality
3. Economy of using resources.
4. Protect the environment lead to increase food safety and quality and processing.

Precision Farming in action to build Smart Farmer.

1. Quality Productivity Improvement
 - Plant species selection
 - Maintenance of soil
 - Water management
 - Plant protection
 - Use of fertilizer based on soil analysis.

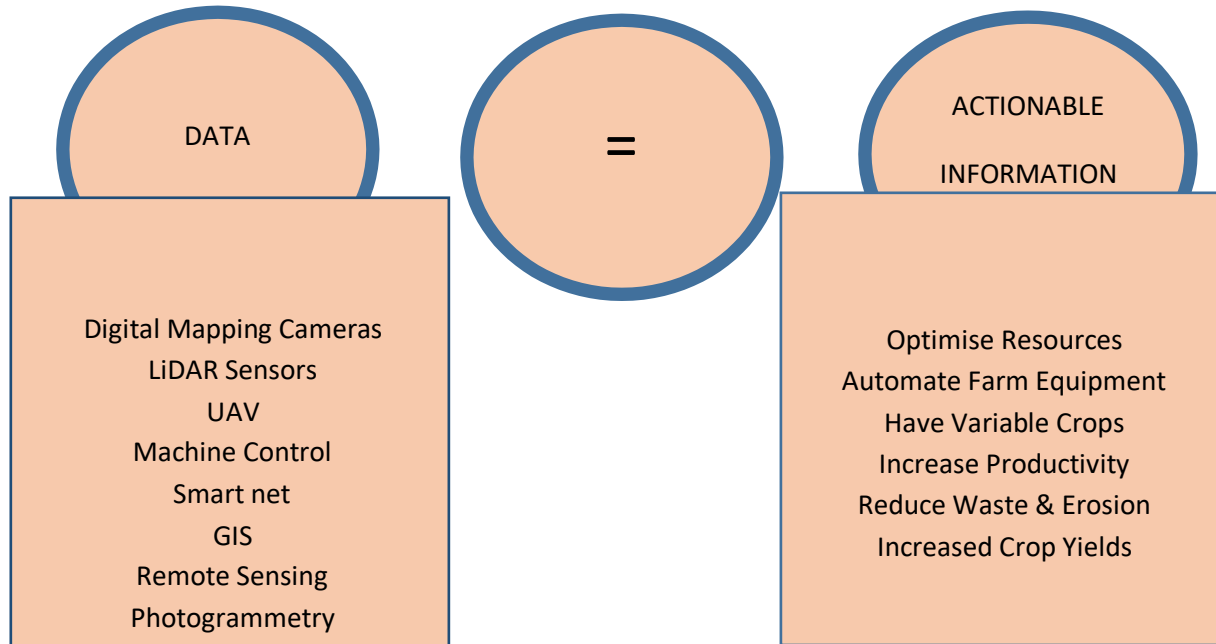
Reducing costs

1. Use of machinery appropriate equipment matching to the farm
2. Use of technology and innovation to create Precision Farming

Knowledge management tools

1. Cluster
2. Supply Chain to Value Chain
3. Business partners
4. Network

**AGRICULTURE
SMARTER WAYS TO DEVELOP AND UTILIZE FOOD
RESOURCES**



Precision Farming: Key Technologies & Concepts

Data Analyze & Evaluation to Design /Blue Print & Monitoring

1. Precision Soil preparation

- Soil preparation is the most important for farmers to do soil preparation system 4.0, emphasis is farm analysis to find the best tools and procedures which will be taken less time to get good soil condition for plants and also for long-term cultivation. Soil preparation is the first step before planting. The ultimate purpose of soil preparation. This is to obtain the area for planting of non-weed seedless seeds with high seed germination.

Soil preparation 4.0

Will use satellite to analyze soil condition. Then the software obtained information such as the height of the area, the control of agricultural machinery used in soil preparation such as laser land leveling machine to adjust the planting area to smooth or tilt the plants.

2. Precision Seeding

- Agriculture Good crop need to consider two important things:

Depth right : If sown very deep the seedlings will not grow but if sown on the surface birds or animals may be eaten and damaged.

Appropriate spacing : If the plant is too dense will not get enough nutrients and enough sunshine to get good production but if planted away too much it will make the land unprofitable.

The use of modern machinery to be able to place seeds in volume and in optimal spacing for maximum yield, this plant will also work with Mechanical sensors

coordinate data from satellite systems and software application call “crop experts programmed”. In hi-tech sowing machines, it will automatically connect to Geo-mapping for automatic sowing.

3. Precision Crop Management Plant protection 4.0

During the growth of the plant farmers need to have maintenance procedures, including:

- The right amount of nutrients.
 - Adequate fertilization, pest and disease prevention
- Proper water supply

These steps are long-lasting and labor-intensive, but with farming 4.0, with the precision farming concept, farmers are more productive. Those tools include:

- Crop sensors
- Automatic wind control
- Optimized boundary spreading

It will make the nutrition and water in the economical way and suitable time.

- Use of the appropriate software come to indicate the agricultural area to provide agricultural machinery use the amount of maintenance such as fertilizer, water, pesticides.

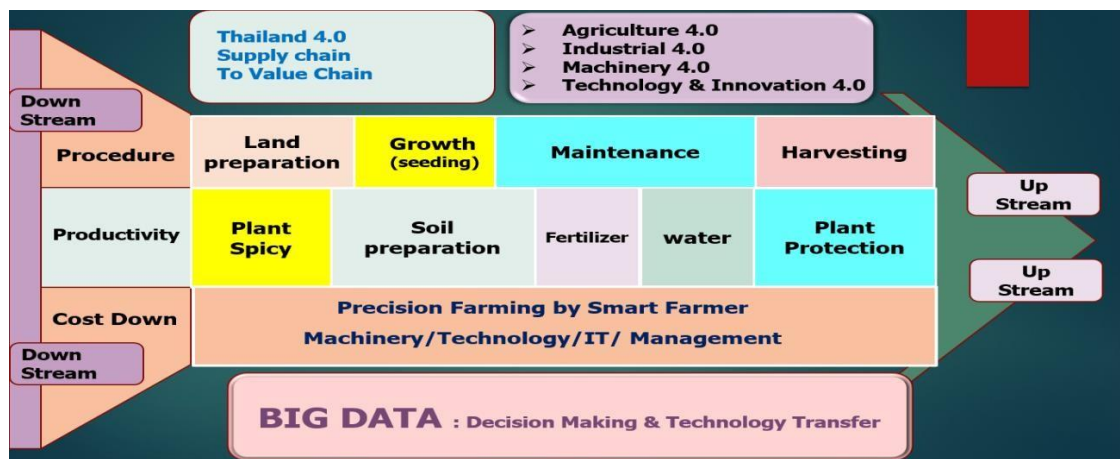
Plant maintenance and the use of unpiloted aircraft technology make the minimize of resources and by using organic products organic vaccines for plant safety and keeping the environmental friendly.

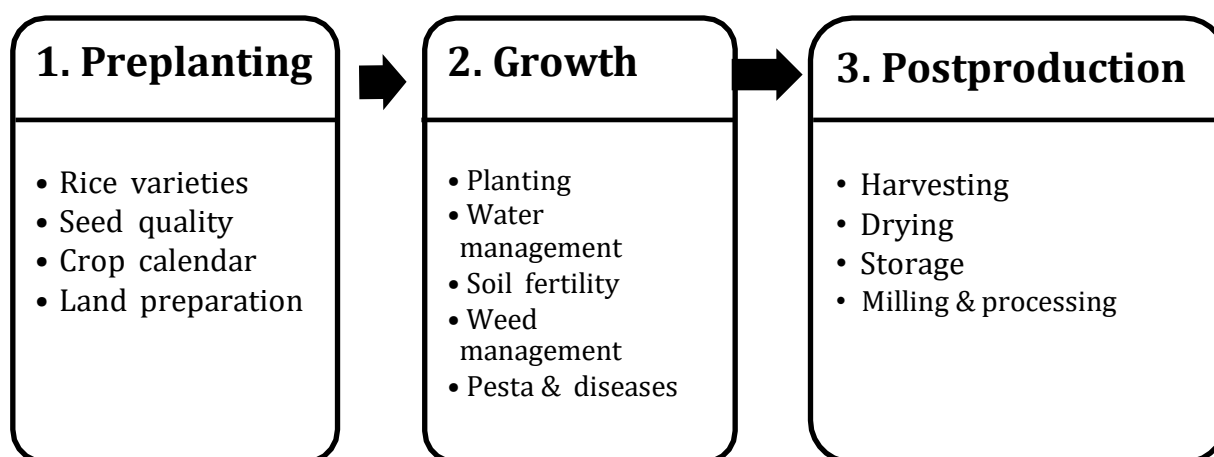
- * Drone
- * Helicopter
- * Chinook

4. Precision Harvesting

- Harvesting 4.0 : The harvesting process is the most importance for the investment in agriculture. Because if the harvest is not so good or use improper tools, it will be damaged during storage. The yield is related to right time harvesting period.

The rest of the harvest such as straw or sugarcane leaves can also be used for livestock or as fuel for Renewable energy purpose. Using satellite systems to view climate data advance to find the best harvest time. This will prevent more damage than ever before. (This system will predict from before planting. Can that season be cultivated) The software system calculates the farmers' productivity. That would be in each growing cycle. And when we use harvester machinery that can process the good yield to suit with the animals feed. It will reduce time and create more value for that product including storage space or transportation is more easier and more economical.





1 Preplanting

Pre-planting activities involve choosing the right variety, developing a cropping calendar, and preparing the rice field for planting.

Rice varieties

How to select rice varieties

Use healthy seeds of a locally adapted variety to get a good crop that has high yield potential and a good market. Each rice growing country should have a list of released varieties within the country. IRRI provides small quantities of seeds on demand to any individual or organization anywhere in the world for the purposes of research, breeding, or training for food and agriculture.

Rice varieties should have Good grain quality (especially cooking characteristics, color, shape, taste and aroma, and head rice recovery)

- High market price
- Optimum yield potential and stability over seasons
- Maximum tillering capacity for weed competition
- Resistance or tolerance to major diseases, insects, and other stresses (i.e. drought and flood) of the area
- The right growth duration (maturity length) to match the season
- Avoid varieties that need to be planted or harvested earlier or later than surrounding rice fields to minimize pest damage (e.g., birds during maturation), and growth problems during times of harmful environmental conditions (e.g., late-maturing varieties running out of water)
- Resistance to lodging under normal farmer management

Factors affecting crop management, such as soil type, planting method (e.g. some varieties are better for direct seeding), fertilizer efficiency, amount of rainfall, climate, disease pressure, should also be considered in selecting varieties.

Seed Quality

How to ensure seed quality

Seed is the foundation of any rice crop. It must be grown, harvested, and processed correctly for best yield and quality results. Sowing good quality seeds leads to lower seed rate, better emergence (>70%), more uniformity, less replanting, and vigorous early growth which helps to increase resistance to insects and diseases, and decrease weeds. As a result, yield can increase by 5–20%.

Factors used to classify rice seeds: Seed purity, Seed viability and Moisture content

Crop calendar

How to develop a crop calendar

Using a crop calendar allows better planning of all farm activities and the cost of production.

A cropping calendar is a schedule of the rice growing season from the fallow period and land

preparation, to crop establishment and maintenance, to harvest and storage.

The crop calendar allows a farmer to:

- plan for input purchase and use
- develop cash flow budget for year
- determine need credit and period requirement
- determine labor requirements and plan for peak usage times
- organize contractors for land preparation and harvesting
 - Determine the best date to plant. This information can be gathered from local experience, agricultural advisors and leading farmers in the district.
 - Determine the time the variety takes from planting to harvest. The length of time from establishment to harvest is known for each variety. It may vary a little depending on the growing conditions especially water availability and solar radiation. Normally short duration varieties take 100–120 days, medium duration 120–140 days, and long duration 160 days plus.

Growth duration diagrams



Transplanted rice

Direct seeded rice

- Most varieties take 60–65 days from panicle initiation to harvest.
- Mark on the calendar the date of planting and then when each other operation needs to be done (plowing, weeding, fertilizing, harvesting).
- Then determine how much labor, equipment and finance will be required at each step during the **growing period**.
- Pin the calendar in a prominent place to remind you when things need to be done.

Land preparation

How to prepare the rice field for planting

Land preparation is important to ensure that the rice field is ready for planting. A well-prepared field controls weeds, recycles plant nutrients, and provides a soft soil mass for transplanting and a suitable soil surface for direct seeding. Land preparation covers a wide range of practices from zero-tillage or minimum tillage which minimizes soil disturbance through to a totally 'puddle' soil which actually destroys soil structure.

It typically involves:

- (1) Plowing to "till" or dig-up, mix, and overturn the soil;

- (2) Harrowing to break the soil clods into smaller mass and incorporate plant residue, and
- (3) Leveling the field. Initial land preparation begins after the last harvest or during **fallow** period. This is important for effective weed control and for enriching the soil. Generally, it will take 3–4 weeks to prepare the field before planting

2 Growth

Important management factors should be considered during the growth of the rice crop. These include planting method, water, fertilizer, weeds, and pests and diseases.

Planting How to

plant rice

Rice crops can be either direct seeded or transplanted.

In direct seeding, seeds are sown directly in the field. While in transplanting, seedlings are first raised in seedbeds before they are planted in the field. When choosing the suitable planting method, the (1) locality, (2) type of soil, (3) rice ecosystem, and (4) availability of inputs and labor, should be considered.

Transplanting may be appropriate if...

- I have a space for nursery.
- I have available resources for seedbed preparation.
- I have equipment for transplanting and/or labor is not a limiting factor.

Direct seeding may be appropriate if...

- I have limited resources.
- I want to reduce labor costs.
- I prefer my crops to mature faster.

Water management

How to manage water

Rice is typically grown in **bunded fields** that are continuously flooded up to 7–10 days before harvest. Continuous flooding helps ensure sufficient water and control weeds. Lowland rice requires a lot of water. Around 1300–1500 mm is a typical amount of water needed for irrigated rice in Asia. Irrigated rice receives an estimated 34–43% of the total world's irrigation water, or about 24–30% of the entire world's developed fresh water resources. Worldwide, water for agriculture is becoming increasingly scarce. Due to its semi-aquatic ancestry, rice is extremely sensitive to water shortages.

Different crop establishment methods require different water management practices:

Soil fertility management

How to manage soil fertility

Applying nutrients to the crop is essential in managing soil fertility so the plants grow and develop normally. A number of crop problems can be related to inefficient management of nutrients and nutrient imbalances in the field. The quantity of application is determined by the target yield and the amount of nutrients needed by the crop. Rice crops need to have the optimum nutritional balance. Macroelements are needed by plants in large amounts. These are carbon, hydrogen, oxygen, nitrogen, phosphorus, potassium, calcium, magnesium, and sulfur.

While microelements are only needed in lesser quantities, often in trace amounts. These are iron, manganese, copper, zinc, molybdenum, boron, and chlorine. If rice crops have more or less than the required amount of nutrients, the yield can be greatly affected.

Weed management

How to control weeds

Weed control is important to prevent losses in yield and production costs, and to preserve good grain quality. Specifically, weeds

- decrease yields by direct competition for sunlight, nutrients, and water
- increase production costs e.g., higher labor or input costs
- reduce grain quality and price for example, weed seeds in grain can cause the buyer price to be reduced.

Weed management should be practiced during specific stages of rice production:

- In the nursery
- During early crop growth

Control of weeds during land preparation is crucial to reduce the amount of weed pressure in the field. Land preparation should start 3–4 weeks before planting. Plowing destroys weeds and remaining stubble from the previous crop. Weeds should be allowed to grow before the next cultivation. In addition, a level field helps retain a constant water level that controls weeds.

Pests and diseases

How to manage pests and diseases

Farmers lose an estimated average of 37% of their rice crop to pests and diseases every year. In addition to good crop management, timely and accurate diagnosis can significantly reduce losses. If you are facing a problem in your crop and need help with diagnosis, seek advice from a professional. Crop problems can be caused by other living organisms, like rats and fungus, or by non-living factors, such as wind, water, temperature, radiation, and soil acidity.

The best control for pests and disease problems is prevention. **To limit pest and disease damage:**

- (1) Practice good cleaning of equipment and field between seasons
- (2) Use clean seeds and resistant varieties
- (3) Plant at the same time as your neighbors
- (4) Do not over apply fertilizer
- (5) Encourage natural pest enemies
- (6) Do not apply pesticide within 40 days of planting
- (7) Properly store grain

3 Post Production

Harvesting

Harvesting is the process of collecting the mature rice crop from the field. Paddy harvesting activities include reaping, stacking, handling, threshing, cleaning, and hauling. These can be done individually or a combine harvester can be used to perform the operations simultaneously. It is important to apply good harvesting methods to be able to maximize grain yield, and minimize grain damage and quality deterioration.

Harvesting process

- Harvesting systems

- Guidelines on proper harvesting

Harvesting rice consists of the basic operations which can be done in individual steps or in combination using a combine harvester. These include:

- Reaping- cutting the mature panicles and straw above ground
- Threshing- separating the paddy grain from the rest of cut crop
- Cleaning- removing immature, unfilled, non-grain materials
- **Hauling**- moving the cut crop to the threshing location
 - **Field drying**- leaving the cut crop in the field and exposing it to the sun for drying (*optional*)
 - **Stacking/piling**- temporarily storing the harvested crop in stacks or piles (*optional*)
 - **Bagging**- putting the threshed grain in bags for transport and storage

Traditional harvesting activities such as field drying and stacking/piling are not recommended because they can lead to rapid quality deterioration and increased harvest losses. Besides these, a variety of other activities can be included in harvesting such as gathering, reaping (gathering standing grain by cutting), bundling, and various forms of transporting the crop and grain.

Drying

Drying reduces grain moisture content to a safe level for storage. It is the most critical operation after harvesting a rice crop. When rice is harvested, it will contain up to 25% moisture. High moisture level during storage can lead to grain discoloration, encourage development of molds, and increase the likelihood of attack from pests. It can also decrease the germination rate of the rice seed. It is important to dry rice grain as soon as possible after

harvesting. Ideally within 24 hours. Delays in drying, incomplete drying or ineffective drying will reduce grain quality and result in losses. Paddy drying methods include traditional and mechanical systems with varying technological complexity and capacities for either farm or commercial level.

Mechanical drying systems

- Guidelines on proper drying
 - Traditional drying systems are still practiced in many areas because of its low cost and ease of management.
 - Sun drying - spreading grains under the sun, on mats and pavements
 - **Mat drying** - used in small to medium-scale drying where threshed grain are placed on mats, nets, or canvas
 - **Pavement drying** - often used in large-scale drying for grain collectors and millers, where grains are laid on pavements specifically made for drying
 - Field drying and stacking - a method for pre-drying hand-harvested crops before threshing where farmers cut rice panicles in the field and stacked them in small piles on top of the crop stubble.

Storage

The purpose of any grain storage facility is to provide safe storage conditions for the grain in order to prevent grain loss caused by adverse weather, moisture, rodents, birds, insects and micro-organisms like fungi. In general it is recommended that rice for food purposes be stored in **paddy form** rather than milled rice as the husk provides some protection against insects and helps prevent quality deterioration.

However, when rice can be stored as brown rice, 20% less storage capacity will be needed. **Brown rice** is rice grain with its hulls removed but not polished. Under tropical conditions brown rice has a very short shelf life, approximately two weeks. Rice storage facilities take many forms depending on the quantity of grain to be stored, the purpose of storage, and the location of the store. Storage systems can be through bag, bulk, or hermetic containers.

- Bag storage- grain is stored in 40–80 kg bags made from either jute or woven plastic
- Bulk storage - grain is stored in bulk at the farm or at commercial collection houses
- Hermetic storage - grain is stored in an airtight container so that that moisture content of the

stored grain will remain the same as when it was sealed. These storages can extend germination life of seeds, control insect grain pests, and improve headrice recovery.

Examples include:

- IRRI Superbag - available to farmers and processors at low cost
- Cocoon - commercially available
- Other locally available containers - useful in rural settings, where local containers can be easily converted into hermetic storage systems

Milling and processing

Milling is a crucial step in post-production of rice. The basic objective of a rice milling system is to remove the husk and the bran layers, and produce an edible, white rice kernel that is sufficiently milled and free of impurities. Depending on the requirements of the customer, the rice should have a minimum number of broken kernels.

A rice milling system can be a simple one or two step process, or a multi stage process.

- **One step milling** - husk and bran removal are done in one pass
- **Two step process** - removing husk and removing bran are done separately
- **Multistage milling** - can be done in the village or local consumption or commercially for marketing rice; rice undergoes a number of different processing steps, such as:

- 1) Pre-cleaning
- 2) Dehusking or dehulling
- 3) Paddy separation
- 4) Whitening or polishing
- 5) Grading and separation of white rice
- 6) Mixing
- 7) Mist polishing
- 8) Weighing of rice

7. Question & Answer

Question 1 : PPITT model ; What is the Public Private Innovation Team Thailand model ?

Answer : PPITT model is the Social Enterprise Business in agricultural management approach and the prototype of a public-private SME It is a combination of all sectors, individuals, individuals, businesses, private foundations, government agencies, all ministries and educational institutions etc.

Question 2 : What is the purpose of PPITT ; Public Private Innovation Team Thailand?

Answer : To solve the problem of integrated agriculture the entire supply chain of the country in both economy, society and environment by seeking the solution to survive, integrate, create an innovation, promote

and develop the future for the nation. In which agriculture it is a solid foundation, stable, concrete stand of the country.

Question 3 : What is the direction of PPITT and How does it work ?

Answer : By technology and innovation to develop "4.0 agriculture" Blended with Thailand 1.0 / 2.0 / 3.0 perfectly with the development of innovative Thai farmers to be Smart Farmer understand access to Precision Farming technology used in agriculture. By integrating the civilian approach by using the "cluster" management as the management tool this will be the basis of the organization of social enterprises (Social Enterprise Business) throughout the supply chain to the value chain.

Question 4 : What is PPITT target group to start with?

Answer : Starts a t 3 agricultural group cluster ;

1. Tapioca Industry
2. Agriculture, livestock industry, dairy / beef cattle
3. Thai rice cultivation

Then expanded to other agricultural groups.

Question 5 : What are the main criteria for selecting agricultural groups?

Answer : Focus on prioritizing priority groups of crops or agriculture as economic crops. The key of the nation and faced competition problems in CLMV or may experience problems in like the global macro level of the nation in the near future, like Tapioca Industry produces flour and ethanol etc. Include opportunities for job creation, get ready immediately to build a medium-term business 3-5 years. such as the course of knowledge transfer on rice cultivation, Thai way to Indonesia or Africa. Production of quality food crops for dairy cattle industry and beef meat.