
THE BUSINESS CASE FOR SUSTAINABLE AGRICULTURE IN ASIA

by

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Abstract

Kellogg Company sources agricultural commodities from around the world to manufacture its products; the company is committed to enhancing the natural resources and livelihoods of the areas and people from whom it sources its ingredients. As part of its Project K Initiative, Kellogg is working to build the global supply chain of the future by making investments in emerging markets. Kellogg seeks to understand how its current work in Thailand and India (with rice and corn, respectively) impacts the triple bottom line. Specifically, this research evaluates impacts on the environment, farmer livelihoods, and with regards to improving Kellogg's top/bottom lines and security of supply.

Rice represents a particular sourcing priority for the Asia Pacific and Africa region because it is needed by every plant in the region and is central for the production of two of Kellogg's most celebrated brands: Rice Krispies and Special K. The company uses a specific variety - medium grain rice - for the production of its cereal. Historically, medium grain rice has grown only in certain temperate regions; however, increasing climatic stress in these areas and the need for a reliable medium grain rice supply to meet the needs of the growing Asia Pacific region led Kellogg to develop its own variety of seed able to grow in tropical climates. In 2014, Kellogg implemented a medium grain rice pilot program in Thailand.

This project uses farmer and expert survey results and desktop research to determine if Kellogg's initiative can provide a viable source of medium grain rice to support the manufacturing of Kellogg products in Asia Pacific while improving farmer livelihoods through improved agronomic practices and income security and reducing negative impacts on the environment. The primary objective of the survey and subsequent analysis was to determine the necessary elements to create a secure and sustainable supply chain for medium grain rice production in Thailand, and to present interventions Kellogg Company can implement to improve production.

Corn is the main ingredient incorporated into a number of products including the iconic Corn Flakes cereal brand. In India, low cost corn, grown with non-GMO seeds, represent characteristics that are paramount for continued use in Kellogg products. Currently, corn accounts for 9% of total cereal production in India with numbers doubling in the past decade and expected to increase. Nonetheless, yields are about half of the global average with climactic conditions and limited technical resources contributing to lack of capacity to increase quality and quantity of yields.

Through interactions with farmers and millers, complexities within the corn supply chain have been better understood. Survey results gleaned from farmer interviews reveal that a combination of pre-harvest and post-harvest practices contributes to the lessened quality and quantity of corn. Additionally, senior-level management identified their concerns and willingness to support proposed strategy interventions based on responses from farmers. Overall, considering farmer and miller perspectives along with senior-level management provides the opportunity to identify the most viable intervention strategies that are low cost and will have a net benefit for key stakeholders.

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Introduction of Medium Grain Rice to Thailand

Kellogg Company (hereinafter referred to as Kellogg) sources agricultural commodities from around the world to manufacture its products; the company is committed to enhancing the natural resources and livelihoods of the areas and people from whom it sources its ingredients. As part of its Project K Initiative, Kellogg is working to build the global supply chain of the future by making investments in emerging markets, like those that comprise its Asia Pacific and Africa region. As the result of a rising middle class and increasing urbanization, sales of Kellogg's products in its Asia Pacific and Africa region continue to grow. In the third quarter of 2014, these regions reported \$264 million in net sales, a 5% increase from 2013.¹

Rice represents a particular sourcing priority for the Asia Pacific and Africa region because it is needed by every plant in the region and is central for the production of two of Kellogg's most celebrated brands: Rice Krispies and Special K. The company uses a specific variety - medium grain rice - for the production of its cereal. Historically, medium grain rice has been grown only in certain temperate regions around the world, including the United States, Australia, Spain, and Italy. With increasing climatic stress in temperate growing areas, evidenced by Australia's Millennium Drought, and the need for a reliable supply of medium grain rice to meet the needs of the growing Asia Pacific and Africa region, Kellogg worked with Thailand's Bureau of Rice Research and Development and other local partners to develop its own variety of medium grain rice seed able to grow in tropical climates such as Thailand.

Following the development of the new seed, Kellogg identified Thailand as the principal location to produce the new product. Because medium grain rice was foreign to Thai growers, in 2014 Kellogg implemented a medium grain rice pilot program with 16 Thai farmers and in partnership with a local mill to begin growing this variety in the Nakhon Ratchasima Province of Thailand. After the rice from the pilot program was harvested in September of 2014 and failed to meet Kellogg's yield and quality standards, Kellogg formed a partnership with one of Thailand's largest agribusinesses to provide technical assistance to a new set of farmers growing medium grain rice.

Project Goals and Objectives

In order to help the Kellogg Company determine the benefits of the medium grain rice pilot in Thailand, a team from the University of Michigan's School of Natural Resources and Environment surveyed the pilot growers. The primary objective of the survey and subsequent analysis is to determine the necessary elements to create a secure and sustainable supply chain for medium grain rice production in Thailand, and to present interventions Kellogg Company can implement to improve production.

Specifically, the following report looks at the survey results to determine if the project provided a viable source of medium grain rice to support the manufacturing of Kellogg products in the Asia Pacific region, helped farmers improve their livelihoods through improved agronomic practices and business skills, and reduced impacts on the environment.

Research Methodology

The team used a mixed methods approach to conduct the project, involving grower and expert interviews and a detailed literature review. Three phases defined the work: (1) a comprehensive literature review and expert interviews to develop the survey, (2) smallholder farmer field interviews using the customized survey, and (3) consolidation of collected data, best practices, and intervention trade-offs.

Survey Development. To form the survey that would be deployed to smallholder rice farmers in Thailand, the team first took stock of the existing landscape of survey tools and studies developed by reputable organizations working in the space. The team conducted interviews with both Kellogg and non-Kellogg employees to understand on-going work and related initiatives, including:

- Amy Braun, Senior Sustainability Manager, Kellogg Company
- Alicia Perdon, Advanced Innovation Team, Kellogg Company
- Richard Berkenshaw, Rice Sustainability Manager, Kellogg Company
- Randal Dell, Agricultural Strategy Manager-Great Lakes, The Nature Conservancy
- Whitney Gantt, Global Director for mAgriculture, Grameen Foundation
- Andrew Jones, Assistant Professor of Environmental Health Sciences, School of Public Health, University of Michigan
- Chris Stevens, Head of Agribusiness and Agronomy for Asia Pacific & Africa, Kellogg Company
- Ed Thistlethwaite, Senior Regional Manager, Agribusiness Asia & Africa, Kellogg Company
- Simon Winter, Senior Vice President, TechnoServe
- Robyn Meeks, Assistant Professor, University of Michigan School of Natural Resources and Environment

Ultimately, the following resources were used to develop the final survey:

- **Sustainable Agriculture Initiative (SAI) Farmer Sustainability Assessment 2.0:** The SAI Agricultural Initiative was formed in 2002 by Nestle, Unilever, and Danone to facilitate sharing of sustainable agricultural practices and Kellogg Company is an active member in policy building and piloting. The farmer sustainability assessment tool is a checklist for farmers to assess their sustainability practices.²
- **Progress out of Poverty (PPI):** A Grameen Foundation developed measurement tool for organizations to integrate poverty data into their assessments.³
- **Unilever Sustainable Agriculture Code:** Developed in 2010, this code is Unilever's definition of sustainable agriculture and outlines expectations of all raw material suppliers.⁴
- **Living Standards Measurement Study (LSMS) - Integrated Surveys on Agriculture:** A household survey project established by the Bill and Melinda Gates Foundation and the Development Research Group at the World Bank to foster innovation and efficiency in research on the links between agriculture and poverty reduction.⁵
- **Sustainability Assessment of Food and Agriculture Systems (SAFA):** Food and Agriculture Organization of the United Nations built on existing efforts and developed this framework to act as a universal standard for the food and agriculture industry.⁶

The final, 133-question survey went through a series of revisions and was reviewed by members of the responsible sourcing steering committee: Amy Braun, Senior Sustainability Manager; Ed Thistlethwaite, Senior Regional Manager in Asia Pacific; and Anchan Sanguansin, Senior Manager-Quality and Consumer Affairs (Asia), for adaptation to the local context before deployment.

Farmer & Key Stakeholder Interviews. From May 9-18, 2014, Juan Pablo Garcia, Joanna Herrmann, and Monica Wyant traveled to Thailand to conduct interviews with smallholder rice farmers. Ed Thistlethwaite and Anchan Sanguansin served as local guides and Somchart Sripirom joined Anchan as a translator. All interviews were arranged through the local mill and were held at three locations - the mill, a receiving station, and a local village.

Over four days, individual interviews were held with 39 farmers, taking approximately one hour each. An additional group interview took place with the local mill owners to understand motivations from the mill perspective. Answers were recorded by tablet using the customized Quicktap survey tool, with additional note taking when necessary. Ten of the 39 farmers were participants in the Kellogg Medium Grain Rice Pilot, as detailed previously, while the other 19 were growers of long-grain or jasmine rice.

The Medium Grain Rice Pilot's first harvest took place in August, at which point Kellogg found the results were not in line with expectations. As a result, Kellogg moved to partner with more professional suppliers/middlemen, and began working with a different farmer population. To capture data on this new farmer population, the team developed a shorter, more focused survey that Ed and Anchan conducted in December 2014. This data has been incorporated in a comparison of farmer populations below.



Data Disclosure and Transparency

A note on interview methodology: As with any self-reported data, especially that reported through translators, a level of bias and inaccuracy must be assumed. This can be attributed to both farmer comprehension (most evident in questions surrounding household income levels), translation inaccuracies, and groupthink (i.e. when other farmers were listening/helping with

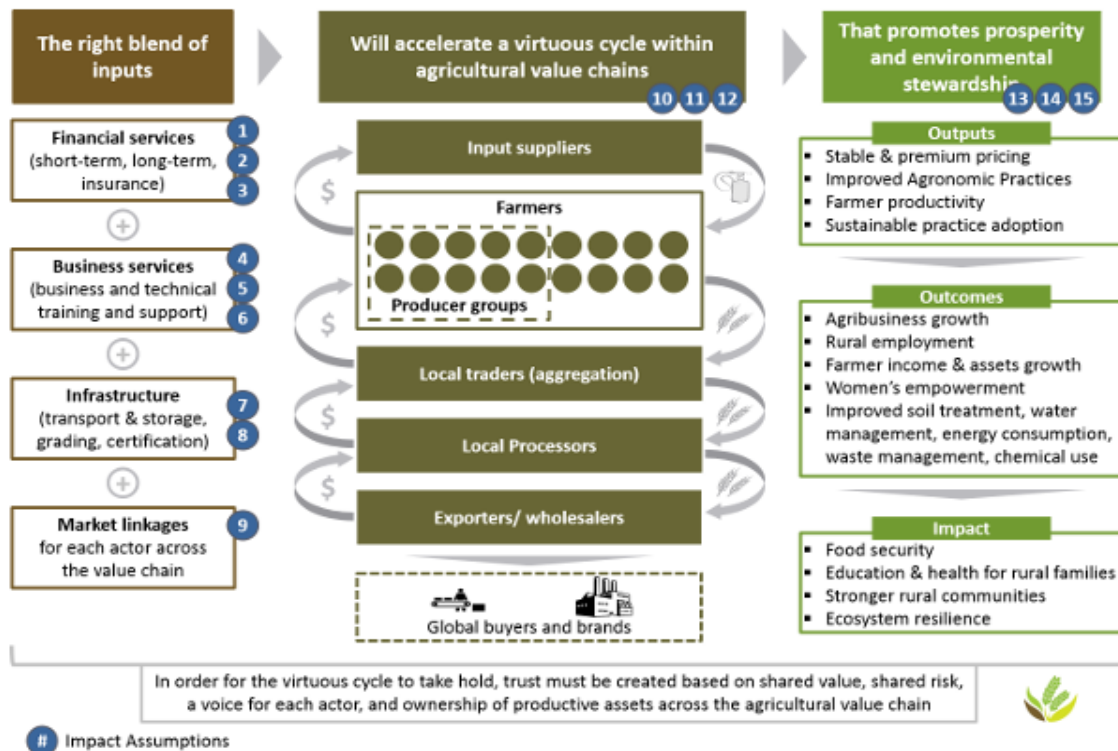
responses). In addition, since most interviewed farmers were also employees and suppliers to the local mill, those taking place within the mills' factory may have felt a conflict of interest. While the project team does not attempt to quantify or project the impact of these considerations, their presence must be acknowledged.

Determination of Best Practices

Universal Theory of Change Smallholder Initiative

In determining best practices, the team undertook an extensive literature review. While there is much written about the topic of smallholder farmer interventions, corporate supply chains, and creating secure and sustainable sourcing relationships, the Initiative for Smallholder Finance's Universal Theory of Change captured the factors at play in a succinct and coordinated manner. The Universal Theory of Change (see Figure 1) was developed through interviews with a large group of stakeholders, ranging from agricultural investors, commercial agricultural brands, agribusinesses, technical assistance providers, and certification bodies. Its purpose is to create a shared vision for how efforts at all levels of the value chain can combine to promote smallholder prosperity and environmental stewardship.⁷ As outlined in the below figure, the theory of change is predicated on the unique blend of inputs accelerating reinforcing causal loops within the value chain. These loops in turn lead to a series of outputs and outcomes that promote positive impacts for the ecosystem. Underlying the entire model is a creation of shared risk and shared value. Kellogg's efforts to establish a sustainable rice supply chain in Thailand can be evaluated using this point of reference.

Figure 1: Universal Theory of Change



International Rice Research Institute

To determine the best practices to be used by Kellogg's medium-grain rice farmers in Thailand, the team turned to the International Rice Research Institute's Rice Knowledge Bank for information. Established in 1959, the International Rice Research Institute is a research organization dedicated to reducing poverty and hunger through rice science, improving the health and welfare of rice farmers and consumers, and protecting the rice-growing environment for future generations. It is a global, independent, nonprofit research and training institute supported by public and private donors. IRRI's goals contributed to the United Nations Millennium Development Goals and are also aligned with the Global Rice Science Partnership, a CGIAR Research program on Rice, that help deliver internationally coordinated research on rice. Since 2009, Kellogg has contributed information to IRRI's work to develop best practices around future rice farming systems by participating in the Consortium for Ecological Intensification of Rice Systems.

The Rice Knowledge Bank is a digital extension service that takes the latest research on rice production and creates practical solutions aimed at smallholder farmers in developing countries. The Rice Knowledge Bank includes step-by-step production information on pre-planting, growth and post-production. It also include Decision Tools, diagnostic tools that help farmers and educators resolve specific rice production challenges. Finally, the country specific Agronomy guides provide information specific to particular countries and in the local language to help farmers make informed decisions.

Climate Smart Agriculture

The team also used the principles of Climate Smart Agriculture to analyze the practices of Kellogg's medium grain rice producers in Thailand. Climate Smart Agriculture was first presented by the United Nations Food and Agriculture Organization in 2010. It incorporates both food security and climate changes challenges and rests on three pillars: (1) sustainably increasing agricultural productivity and incomes; (2) adapting and building resilience to climate change; (3) reducing and/or removing greenhouse gas emissions wherever possible. Climate Smart Agriculture requires site-specific analysis to identify solutions that address economic, social, and environmental sustainability.⁸

Many food and agriculture companies are using Climate Smart Agriculture principles to make sustainable sourcing commitments for their ingredients. These responsible sourcing commitments require compliance on social and environmental metrics that include land use, greenhouse gas emissions, fertilizer use, water quality, soil conservation, energy use, labor standards, and producer livelihood improvement. Businesses measure success against internally created supplier codes, continuous improvement against industry based environmental metrics like those of the Field to Market Alliance, and certification by outside entities like the Rainforest Alliance.

Report Outline

The key findings of research and analysis from this project are presented in the following four sections. **Section 1** discusses the current situation in the target country - Thailand, highlighting the state of the agricultural industry and smallholder farmers through interview data. **Section 2** covers sustainable supply chain development from a best practice perspective, benchmarking against the International Rice Research Institute and peer multinational corporations. **Section 3** introduces Kellogg's sustainability initiatives and benchmarks them against peer companies. **Section 4** introduces the Medium Grain Rice Pilot and does a deep dive into the data and analysis of economic, environmental, and livelihood indicators. **Section 5** models a cost-benefit analysis and highlights the opportunities Kellogg has to make a tangible impact in this supply chain.

Section 1: Thailand and Rice

The Kingdom of Thailand is located in Southeastern Asia, bordering the Andaman Sea. It is characterized by having a tropical climate: rainy, warm, with monsoons in different seasons depending on the region. It has a population of 68 million people - 66% live in rural areas of which almost half work in agriculture.

The Kingdom has a well-developed infrastructure, a free-enterprise economy, generally pro-investment policies, and strong export industries, Thailand achieved steady growth due largely to industrial and agricultural exports. Unemployment, at less than 1% of the labor force, stands as one of the lowest levels in the world, which puts upward pressure on wages in some industries. Thailand also attracts nearly 2.5 million migrant workers from neighboring countries. In 2013, the Thai government implemented a nationwide 300 baht (\$10) per day minimum wage policy and deployed new tax reforms designed to lower rates on middle-income earners. However, Thailand has a high level of income inequality and the benefits of a minimum wage do not reach the smallholding and/or subsistence farmers in the rural areas.⁹

The Thai population income disparity is high, they score 39.4 on the GINI index and occupy 62nd place (out of 142). According to the United Nations Development Program 6.1 million (12.6%) people are poor (i.e.: below the UN poverty line of \$1.25), and 88% of them live in rural areas.¹⁰ Thailand's poor population is characterized by the following:

- Poverty is concentrated in the Northeast, North, and South regions.
- The majority of the poor lives in villages and are engaged in farming. However, the poor do not rely solely on farm income, and tend to derive most of their income from off-farm sources.
- Larger family sizes.
- Average education attainment level tends to be lower among the poor, which restricts them from accessing high wage employment opportunities.
- Little landholdings, if any.
- Limited access to basic social services such as water and sanitation.

- The heads of poor households are more likely to be elderly, retired workers, or disabled. This implies that the coverage of social security services is not sufficient.¹¹

These characteristics are on par with the information from the surveys performed with both groups of rice farmers, although some key differences arise from land size and water access. Please see the Farmer Information section for more detail.

A brief history of Thailand takes us back to the 1970s, when it began advancing from a rural, low-income economy into an industrial, medium-income one, vastly reducing poverty rates and sustaining constant economic growth for almost three decades¹². Currently, services account for most of Thailand's GDP (44%) while agriculture is measured at 12%;¹³ however, farming related activities provide jobs to 40% of the population, making it the most influential labor sector for the country.¹⁴

According to the World Bank, Thailand has advanced in the Ease of Doing Business Index by removing regulatory hurdles and opening up resources for starting new businesses, among other factors.¹⁵ Moreover, the Kingdom maintains the lowest level of corruption compared to its neighboring countries, making it an attractive target for foreign investment.¹⁶

Thai Rice

Rice is economically and culturally important to Thailand. The country claims to be the highest producer and exporter of high-quality and aromatic Jasmine rice. Rice occupies 55% of Thailand's arable land and is the staple food of the population across income brackets. Thailand also has such an extensive milling capacity, that it's currently only using 33%. Looking past these facts, rice has strong cultural ties with the Thai people. Ceremonies invoking rain and bountiful harvest are commonly performed by rice farmers before planting seasons¹⁷.

Prime Minister Yingluck Shinawatra introduced the Rice Pledging Programme in 2011 as a key part of his campaign. It created a direct subsidy that paid a minimum price to farmers for their crop (\$437USD/tonne for white rice, \$610USD/tonne for jasmine rice), which was higher than real prices by up to 50% in some occasions. This policy negatively impacted the competitiveness of Thailand's agricultural sector while creating a budgetary deficit for the country of an estimated \$4 Bn in the first quarter of 2014 as the market price for rice was well below what it paid the farmers.¹⁸ Additionally, it created negative incentives for rice farmers to maximize yields at the expense of quality, diverting resources away from investment in technology aimed at raising crop yields and overall productivity.¹⁹

Globally, the price of white rice grew steadily from 2000-2008 when it reached an all time high at \$1,015USD/tonne, given the generalized occurrence of natural disasters that either flooded or brought drought to producing countries. Since then it has oscillated between \$400-600USD/tonne.

In May of 2014, a coup d'état ousted Prime Minister Yingluck Shinawatra and his members of government for corruption and political deadlock²⁰. The military set up a junta and dissolved the

parliament, and is striving to create policies that promote economic prosperity. One of the coup policies has been to modify the Rice Pledging Programme.

The new Rice Farmer Assistance Program consists of soft loans, input subsidies, and price stabilization measures. Farmers will be eligible to apply for six-month loans with 3% interest rates through the program, as compared to 7% in the open market. The program is expected to help reduce rice production costs by THB150/rai (USD29/hectare). In addition, the government is encouraging the private sector to discount farm inputs and equipment supplies, including land and combine harvesters, to support the program. The discount is expected to lower the production costs by another 432 baht per rai (USD83/hectare). Finally, the government plans to keep the price of rice paddy between THB 8,500 - 9,000/tonne (260 - 277 USD/tonne). The absence of a price subsidy will mark the first time in decades²¹ that the rice industry in Thailand will operate without direct state intervention. This new policy will be less disruptive for exports as it should decrease the cost of rice production and maintain Thai export prices at a competitive level.²⁰

The main risk for Thai rice production is climate variability, in particular the return of El Niño in 2014 bringing hot and dry weather to the region which decreased the density of the monsoon season. However, the new government will have the opportunity to unload the large rice reserves that the previous administration held (to avoid selling rice at a loss), while the neighboring producers suffer from lower production levels.²²

Another threat for Thai rice is the solidification of the Association of South East Asian Nations (ASEAN) Economic Community (AEC), which is to be completed by 2015, as it will remove rice import duties and improve Vietnam's pricing in the eyes of buying countries. The Thai Rice Exporters Association has two recommendations to adapt to this scenario: First, Thailand should become a 'one-stop rice shop' for buyers by importing paddy grain from neighboring countries and using its huge spare milling capacity (2/3). Second, Thailand should specialize in the high-quality rice market by leveraging its current position and improving export values in the process.²⁰

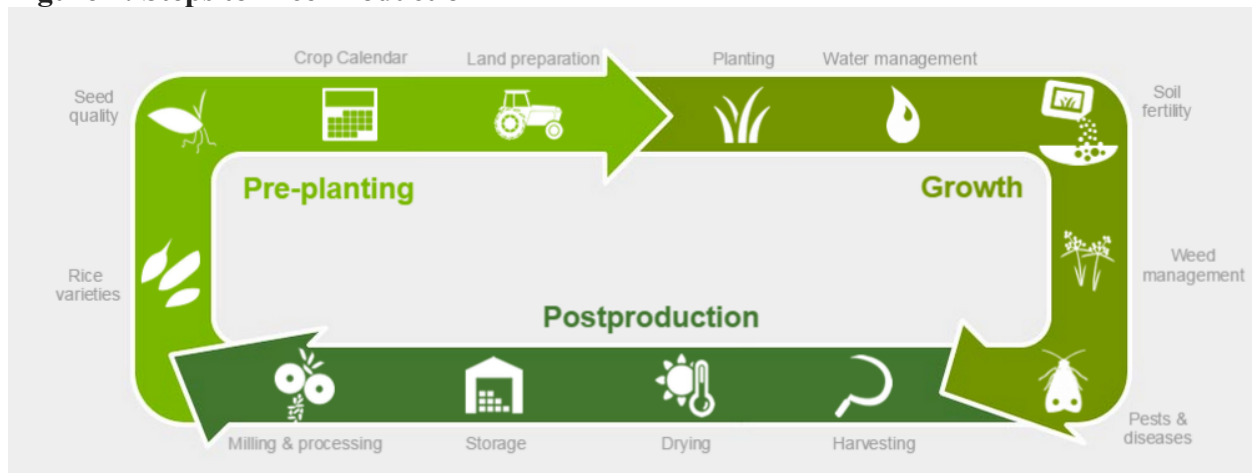
Section 2: Sustainable Rice Production

Rice is the daily staple for more than 3.5 billion people - the majority of whom reside in developing countries - making up more than 20% of daily caloric intake. Rice cultivation is the principal source of income for 100+ million households in Asia, Africa, and Latin America. Global rice demand is expected to increase fifty percent by 2050. While the Green Revolution in the 1970s and 80s enabled rice production to stay in line with demand, production since 2000 has "been less than rice consumption and the deficit has been addressed by drawing on rice from buffer stocks."²³ Global climate change presents substantial risk to rice production, as temperature increases and changes in rainfall patterns modify land and water resources for rice production. Under current farmer practices, rice production uses 34-43% of the world's irrigated water (24-30% of developed freshwater resources) and is responsible for 5-10% of global methane emissions.²⁴ Under this context, growing rice in a sustainable manner is increasingly important. Sustainable rice production refers to both the growing methods - i.e. minimizing

waste and water availability - as well as social implications of food security, financial independence, and gender equality.

Rice cultivation is extremely labor intensive and has a high degree of seasonality. The International Rice Research Institute (IRRI) outlines the following key steps in growing rice (Figure 2).

Figure 2: Steps to Rice Production²⁵



Pre-Planting: Before planting, farmers must ensure the quality of both seed and land. Most Thai farmers reuse seed for multiple crops, which can diminish the quality over time.

- Land preparation involves plowing to *till* the soil, breaking apart the soil to mix with plant residue (*harrowing*), and *leveling*. Generally a 3-4 week process, land preparation typically includes saturating the soil with enough water to produce a water layer for plowing and leveling before transplanting seedlings. Best practices include shallow, dry-tillage of soil after a previous harvest to allow the topsoil to act as mulch, which reduces soil dehydration and cracking.²⁶ In water-scarce areas, dry preparation is an option as well as Alternate Wetting and Drying (AWD) but these activities can lead to trade-offs in productivity if not managed closely. Leveling improves water use efficiency, increases grain yield, and improves grain quality. Research has demonstrated that land leveled fields reduce weeds by up to 40%.²⁷

Growing: The growth of a successful rice crop depends on water, weed, and pest management, in addition to ensuring soil fertility.

- Planting: Rice crops are either directly seeded into the field or raised in seedbeds and transplanted. With direct seeding, 35 kilograms of medium-grain rice seeds are required per hectare and the first 21 days are the most critical; transplanting requires 40 kilograms per hectare and close management for the first 10 days.²⁸
- Soil Fertility: Site-specific nutrient management (SSNM) is the ideal process for managing nutrient needs to specific field conditions. Leaf color is a proxy for nutrient needs and should determine the mix of fertilizer needed as supplements.²⁹ Each crop removes substantial quantities of Nitrogen, Potassium, Phosphorous, and Sulfur from the soil. Fertilizer is a key stabilizer to nutrient cycling, however applying fertilizer at the right time and in the right nutrient proportion continues to be a challenge among smallholder farmers.³⁰

- Water: Rice grows best in banded fields, or paddies. Four types of rice ecosystems exist: upland, rain fed lowland, irrigated, and flood-prone. Irrigated lowland constitutes 75% of the world's rice production. Flooded soil helps control weeds and ensure the crop does not suffer from water stress. On average, it takes 1,432 liters of water to produce 1 kilogram of rice in an irrigated lowland production system.³¹ The majority of water use in rice growing takes place in land preparation and soil irrigation. Irrigation presents increased risks of salinization, soil erosion, and pesticide contamination.

Post-Production: For the Thai smallholder farmers, the majority of who do not have or want storage facilities, harvesting is the final important rice production stage. Harvesting consists of cutting, stacking, handling, threshing, cleaning, and hauling. Harvest timing depends on seed variety, and is indicated by moisture content, number of days after sowing and heading, and ripe grains per panicle.³² Kellogg's preferred moisture content is 12-13% for medium grain rice, which, is milled two months after harvest and stored one month after milling.

Value Chain

The rice value chain is highly fragmented and complex, characterized by a smallholder-based production system, with 200 million smallholder farmers responsible for growing the majority of worldwide rice. Only 5-7% of rice enters global trade flows, with the rest kept domestically for consumption.³³ Of the rice kept domestic, more than half is consumed by farmer households. Rice for sale occurs mostly on irrigated land on farms over 2 hectares. Under this context, the rice value chain represents the small proportion sold outside the household.³⁴

Kellogg Company global procurement strategy is to work with suppliers to procure high quality, specified product from a commodity market. Unlike peers, Kellogg Company is not vertically integrated and has very little control of seed selection or management practices, since Kellogg does not directly contract with growers. General Mills, as the name indicates, owns their own milling operations in the United States and, until recently, their own elevator network. This allows direct contractual obligations to various best management practices where practical. Similarly, Heinz and Frito-Lay are well known for having their own varieties of seeds perfectly suited for their production processes. To contract grow for these companies, growers must plant these seeds and manage the crop in an approved way. Nestle and Unilever have invested heavily in breeding, farming, and agronomic teams.

Globally, Kellogg Company has very limited influence of grower seed selection and practices, although this is evolving. A recent project in North American corn has engaged growers – through a miller – to reduce the number of hybrid seeds from hundreds of varieties to just forty. For hard to source ingredients, like waxy barley, Kellogg Company has contracted with suppliers and millers to ensure supplies. The miller than directly contracts with growers to plant acres of the ingredient. The Asian rice project reviewed here is the first large-scale engagement directly with a miller and grower to cultivate a new crop, with new seeds and new practices, for Kellogg. This process has the potential to build a new engagement model for Kellogg research and procurement teams, and influence the security of supply, cost, and sustainability of the project.³⁵

Section 3: Kellogg Company Sustainability Strategy

The Kellogg Company has been recognized for its environmental and social corporate responsibility strategy year after year, including being awarded one of the “World’s Most Ethical Companies” by the Ethisphere Institute, “World’s Most Admired Companies” by Fortune, and “Best Global Green Brands” by Interbrand. The following section details Kellogg Company’s environmental, social, and rice-specific commitments that are most relevant to the medium grain pilot program in Thailand.

Environmental and Social Commitments and Initiatives: Kellogg Company is committed to reducing its greenhouse gas emissions as well as the energy and water it uses. Working with its suppliers, millers, and farmers to implement sustainable agriculture practices is a central tenant of this strategy. Kellogg is helping its growers optimize use of fertilizer inputs, improve soil health, enhance watershed quality, and optimize water use. In addition, it is estimating greenhouse gas (GHG) emissions and measuring continuous improvement. By December 2015, the company will establish a climate change adaptation strategy that incorporates the needs of smallholder farmer in its supply chain. In addition, it is working with the University of Minnesota's Landscapes Initiative to share data and maps that illustrate the effects of climate change on major crops across the globe. It has also pledged to achieve zero net deforestation in high-risk supply chains by 2020, and to include climate and deforestation policies in its Supplier Code of Conduct and supplier expectations.

Kellogg is also committed to supporting its growers, especially its smallholder and women farmers, by giving them the tools to improve their agronomic practices and business skills. By 2015, Kellogg will validate social compliance across all direct suppliers. In addition, by 2020 the company will sustainably source corn, wheat, rice, oats, potatoes, sugar, cocoa, palm oil, fruits, and honey.

Rice Specific Commitments and Initiatives: In 2011, Kellogg Company joined the United Nations Environment Programme, the International Rice Research Institute, and Louis Dreyfus Commodities to create The Sustainable Rice Platform. The purpose of the initiative is "to promote resource efficiency and sustainability in the global rice sector through an alliance that links research, production, policy marking, trade and consumption."³⁶

In May of 2014, Kellogg furthered its commitment to sustainable rice production by announcing its intention to promote and support initiatives with producers in every country in which Kellogg sources rice globally. The result of this work will lead to a 25% increase in the adoption of Climate Smart Agriculture practices by 2020.

Peer Organization Best Practices

A November 2014 briefing - *Technical Assistance for Smallholder Farmers: An Anatomy of the Market* - noted that “Over the past decade, technical assistance funding in developing countries has seen a steady rise and a trend towards incorporation of market linkages and greater use of technology. [This has included] food and agriculture companies have increased investment in supply chains to strengthen sourcing relationships.”³⁷ In recent years, technical assistance funding has trended towards supporting more global and complex agricultural value chains,

technological improvements, and the inclusion of women, as well as wider programming to include health and nutrition, access to finance, and conservation.³⁸

Many of Kellogg Company's competitors are also working to implement environmental and socially sustainable practices into their work in order to benefit their supply chains in the long run. The following is a review of rice specific initiatives implemented by peer organizations and other programs that seek to address larger agricultural issues that Thai rice growers are facing.

Pepsico: In 2012, Pepsico launched its Sustainable Farming Initiative (SFI) focused on potato, citrus, rice, corn, and oat crops in order to measure the social and environmental impacts of the products it sources. The SFI provides a framework based on the following sustainability categories and indicators: environmental (agrochemicals, air, biodiversity, energy, greenhouse gas emissions, nutrients, soil, waste, water), social (employment conditions, employment practices, community, health, wellness, and safety) and economic (management practices, efficiency, and commercial relationships). Specific to rice, Pepsico has been successful in working with its suppliers to convert rice acres to direct seeding. In this method, rice seed is planted and grown directly in the field rather than the traditional method where rice is grown and then transplanted into standing water. The change has resulted in water savings of over 11.2 billion liters.³⁹

The Coca-Cola Company: Water is of particular importance to rice farmers in Thailand. Survey results showed that in recent years some farmer groups have been affected by drought conditions that have harmed the productivity of their crops. Many companies are making sustainable water commitments, including The Coca-Cola Company. The company is committed to improving its water efficiency by 25% and has partnered with the World Wildlife to provide guidance and identify opportunities for conservation. In addition, Coca-Cola's goal is to become water neutral by 2020, in part by replenishing the water it uses back to communities and nature and by working with local community leaders to create source water protection plans for its 900 bottling plants in 200 countries.⁴⁰

Unilever: The Unilever Sustainable Living Plan spans its entire portfolio of brands in all countries in which it works and across the whole value chain from initial sourcing to consumer packaging. By 2020, Unilever is committed to putting its environmental footprint in half, including its greenhouse gas emissions, water use, and waste. In addition, by 2020, it will source 100% of its agricultural raw materials sustainably and will engage with at least 500,000 smallholder farmers to improve their livelihoods. Specific to water, Unilever co-founded the Water Footprint Network to develop a framework that measures the total water used across the lifecycle of its products and the impacts of that water use.

Nestle: Nestle has committed to developing and implementing a Rural Development Framework and putting baseline assessments in place in 21 countries in which it works that show social need. The purpose of the framework is to align business activities with local priorities for community engagement, impact assessments, and rural development programs. Recognizing that farming populations are aging and younger generations are leaving rural areas for urban centers, Nestle is working to create programs that offer a secure income and opportunities for social advancement to its growers. The core areas of the framework include: Farmer Net Income,

Farmer Knowledge and Skills, Labor Standards, Women's Empowerment, Clean Water and Sanitation, Nutrition and Health, Property Rights, and Natural Resource Stewardship.⁴¹

Section 4: Medium Grain Pilot

Farmer Population 1

The partner for the initial pilot was a local milling company that produces 4 types of rice and has an added production of 100,000 tonnes of rice annually. The mill sources grain from a 400 km radius, 10% from individual farmers, and 90% from middle-men (aggregators). It has 200 recurrent customers that make their purchasing decision upon market conditions and quality. Kellogg is a primary purchaser that signs a yearly contract with a set price.

The mill considers that some of the issues that result in low yields for the small farmers of the region are: lack of secure irrigation resulting in weather dependence, too much seeding, lack of best practices training (inputs and labor wise). However, the idea of setting up a pilot with them was to see the viability of providing the required interventions by hiring field managers and agronomists and ensure Kellogg's quality requirements.

For setting up the pilot, the mill provided 1 full time and 2 part time employees to deal with Kellogg's requests and the farmers growing medium grain rice. If the pilot were successful, the mill would provide 10 FTE to set up a new department for seeding, contract farming and providing technical training on fertilizer application and timing, even though these are not services they offer to other customers or farmers. There was also an idea of having a Kellogg only building and dedicated machinery. The mill forecasted that a problem with farmers and medium grain rice would be the lower seeding requirements compared to jasmine or regular rice as the farmers tend to over seed in the hopes of elevating yields, as well as the need for Kellogg to have a person on the ground for support and managing the field staff in charge of aiding farmers.

As a result, the initial pilot was unsuccessful given the lack of capacity the mill had to ensure Kellogg's best practices in the field and in the mill were being followed. The services provided by the mill are not sufficient to establish a long-term production culture because their main expertise is in milling and not in working with farmers to ensure production levels and quality. Kellogg needs a partner that can ensure high quality grain and will provide the services that farmers need to achieve it. Moreover, the farmers presented by the local mill as the producers for the pilot are not in a water rich region, which would have made a long-term production impossible either way.

Although the mills' capabilities reside mostly in providing pricing information and general outlines for the quality of the paddies to the farmers, the company does not have its own agronomists nor do they outsource technical assistance to provide the farmers. This lack of control over the quality and the farming practices of the farmers lead the pilot to fail. The result was a lesson on what services does a partner in Thailand need to provide to make medium grain rice production successful.

Farmer Population 2

Taking the learning from the initial pilot, Kellogg found a partner that could ensure production quality at an attractive price, one of Thailand's largest companies that work with many small-holder farmers for grain production. As mentioned above, the agribusiness has the capabilities to ensure the quality of the grain by providing technical assistance and ensuring that the growers perform the required interventions for high yields. What follows is a detailed comparison of the two farmer populations and discussion on the differences that arose.

Kellogg's current rice production partner is an integrated global food company that mills and processes various products, including grains and proteins, in bulk and retail. The agribusiness has operations in 10 different industries. Most of the business resides in farming activities, grains, proteins and fish, and provide services of production, manufacturing and also have their own brand of products. As with other global companies, the capacity of the agribusiness to maintain the quality required by its customers is what it allows it to grow, which makes it a good fit for Kellogg's grain quality requirements.

The agribusiness and Kellogg Company are working together to build farming policies to maintain quality and competitive costs while working with many farmers. The policies focused on here are the interventions that affect rice production, specifically for the Kellogg medium grain rice project. These policies, with the agribusiness' grower engagement and Kellogg Company management, are helping deliver clean and pure rice production for use as seed or in processing. This plan establishes long term relationships given the improved productivity generated from new advantaged varieties, good seed, good agricultural practices, better milling percentage (local mill 40% compared to agribusiness 55%) that leads to huge productivity gains, and is also benefitted from a well-managed supply chain and transparent mill, with the best variety delivering the right chemical and physical attributes Kellogg requires. The agribusiness is currently offering interest free credit to growers for production inputs including seed, fertilizer, and chemicals. This is a great asset to the agribusiness' farmers because rice production cycle can take up to 6 months, and the input costs represent 80% of their income, which now can be used to cover other needs.

Farmers working on this program perform the following interventions to improve their yield and quality:

- 1) Farmers are trained for and perform soil analysis to verify the status of the soil before planting.



2) After the soil analysis comes the land preparation. Farmers use tractors to level the soil and ensure that all of the crops receive the same amount of resources.



3) In the seedling process, the agribusiness uses an automatic rice paddy seedling system and puts the plants in seedbeds to ensure the quality and distribution of the seeds. The result is twofold, there is less seed waste, and there is better control of the seeds planted. The agribusiness has provided direct wet seeders and direct dry seeders to remove the nursery requirement while reducing planting labor and increasing planting speed. These are unique machines that the agribusiness purchased to support Kellogg's operations.



4) The seedbeds are distributed to the farmers who keep them in wetland until they are ready for being transplanted.





5) When the plants reach the appropriate height, they are transplanted to dry land, where water management can be more effective.



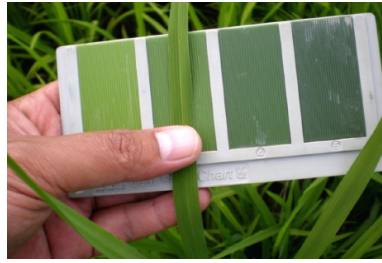
6) Once the rice is transplanted, the Alternate Wet and Drying (AWD) water management takes place by flooding the land and letting it dry. AWD has fewer methane emissions and helps save water compared to constant flooding water management.



7) During this stage fertilizer is also applied. The agribusiness has its own type of fertilizer with two specific amounts of nutrients: 30-8-4 for vegetative state and 32-0-17 for reproductive state. This avoids the incorrect use of other fertilizers and helps regulate quality along the farmer pool.



8) As the growth stage takes place, the agribusiness pushes for constant nutrient evaluations and farmers attain to this as they know they are required to provide a certain quality of rice.



9) To keep weeds and check for plagues, the farmers perform quality control checks on the plots by rouging 3 times and being certified by an agribusiness inspector to ensure quality.



10) Finally, to be harvested the field must be certified by the agribusiness. The factory (mill) is 12 hours away from the fields, making it a suitable option.



Survey Results- Basic

Farmer Groups (hereafter abbreviated to FG) 1 and 2 can be characterized as follows in Figure 3:

Figure 3:

Basic Information	Farmer Group 1	Farmer Group 2
Number of interviews (n)	39	19
Average age	55	48
Gender	64% Women; 36% Men	27% Women; 73% Men
Average house size (bedrooms)	2.2	1.9
Average years owned/rented land	24 years (own) 11 years (rented)	21 years (own) 12 years (rent)
Average hectares of rice per farmer	3.0	4.8

From the basic information, we can see that the main difference is the size of the farms. FG2 has in average 58% more land producing rice than the average grower in FG1.

Ownership Information: Many farmers in both groups both owned and rented land. In a comparison of land ownership status, FG2 has, on average, more hectares of land that they own (5.4 ha as compared to 2.3 ha in FG 1) and slightly more that they rent (3.2 ha as compared to 2.3 ha). For both groups, the growers that own and rent land do slightly better on average than those who only own or only rent. This could indicate that the farmers who have better practices look for more land to increase their productivity.

Farmer Livelihood Indicator and Impact Analysis

The social impact of smallholder farming include a series of livelihood metrics, ranging from grower education, grower safety, gender dynamics, income levels, access to financing (credit/debt), and access to information/markets. Data collected through randomized control trials and longitudinal studies have demonstrated that providing market linkages to smallholder farmers improves incomes and decreases poverty. Causality is difficult to pinpoint, but farmers participating in value chains have a higher likelihood of reduced poverty.⁴² More productive and resilient farms lead to job creation and improved outcomes for farmers. While sustainable farming practices are strongly linked to profitability over the long term, more research is needed to determine if these long-term benefits offset the short-term costs.⁴³

Commonly agreed upon and used farm-level metrics collected by value chain actors to measure social impact are as follows⁴⁴ (* represents questions included in our farmer survey):

- Ownership of cell phone*
- Perception that target crop provides viable livelihood for future generations
- Poverty status/PPI score

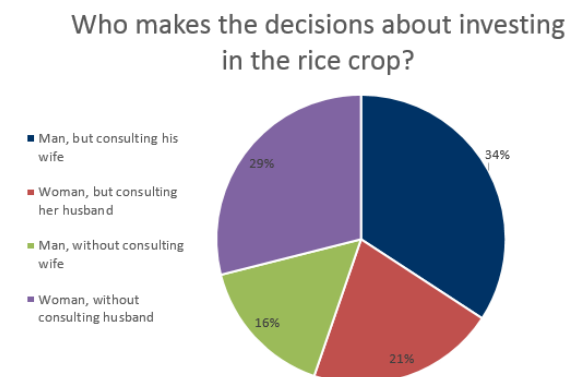
- Total farmers reporting an increase in annual revenue or savings
- Farms with women as head of farm*
- Gender of household member doing primary work in target crop*
- Food scarcity*
- Access to education for school-age children (by gender)*
- Knowledge of price and what sets price*
- Perceived price fairness*
- Utilization of a savings account*
- Outstanding loans*

When captured at the start of an intervention/partnerships, these indicators can provide a baseline for comparison over time. Key findings from the farmer populations interviewed in this study are as follows:

Gender Dynamics

Gender plays an important role on the farm. The process around decision-making was only asked of FG1, which reported that farm decisions are made primarily by men after consulting their wives (34%) followed closely by women without consulting their husbands (29%). It is evident that women play a strong role in the decision-making process (Figure 4).

Figure 4:



Both farmer groups reported that mainly men work on the field; however, there might be some bias in the data given that the survey for Farmer Group 1 was answered by 37% men and for Farmer Group 2 it was 73% men. More detailed questions specifying the activities on the farm could perhaps lead to a less biased response (Figure 5).

Figure 5:

Who does most of the work on the farm?	Farmer Group 1	Farmer Group 2
Mainly men from the family	62%	84%
Mainly women from the family	23%	11%
Hired labor	15%	5%

Education Levels

Formal education at the head-of-household level for both groups of farmers is limited to primary school and junior high, with farmer group 1 containing several outliers. The strong majority of men and women in the second farmer group only completed grade/primary school, with 16% making it through junior high. However, both groups demonstrated a strong interest in providing education for their children. In Farmer groups 1 and 2, the children of farmers far exceeded their parents' highest education level achieved, with 22% and 25%, respectively, having attended or graduated from university. It is important to mention that the children's education numbers are current levels rather than final levels, like their parents' (Figure 6). In other words, the majority of children will continue to receive education and reach higher grades.

Figure 6:

Formal Education Levels - Farmer Group 1 vs Farmer Group 2

	Male Head of House		Female Head of House		Children Over 12	
	FG 1 (n=37)	FG 2 (n=19)	FG 1 (n=38)	FG 2 (n=19)	FG 1 (n=50)	FG 2 (n=32)
None	5%	0%	8%	0%	0%	9%
Grade/Primary School	70%	79%	60%	68%	12%	13%
Junior High	8%	16%	10%	16%	26%	25%
High School	14%	5%	16%	11%	26%	0%
Vocational School	3%	0%	3%	0%	14%	28%
College	0%	0%	3%	0%	22%	25%

Financial security

During surveying, the team found financial information very hard to confirm with other data at our disposal. While farmers knew the price they sold their crops for, and often times the costs spent on fertilizer and other necessities, the total revenue and costs numbers had to be calculated by interviewer through leading questions. Whether due to translation difficulties or a lack of financial literacy, the team is not confident in the income information. Perhaps the most interesting data points were that of savings and debt.

A deeper analysis to understand the financial management done by both groups could be done by obtaining detailed information about the type of debt of the farmers and the sources of the off farm income. The fact that Farmer Group 2 has significant participation in savings and yet a high level of debt could point towards being long term debt, or working capital for farming activities.

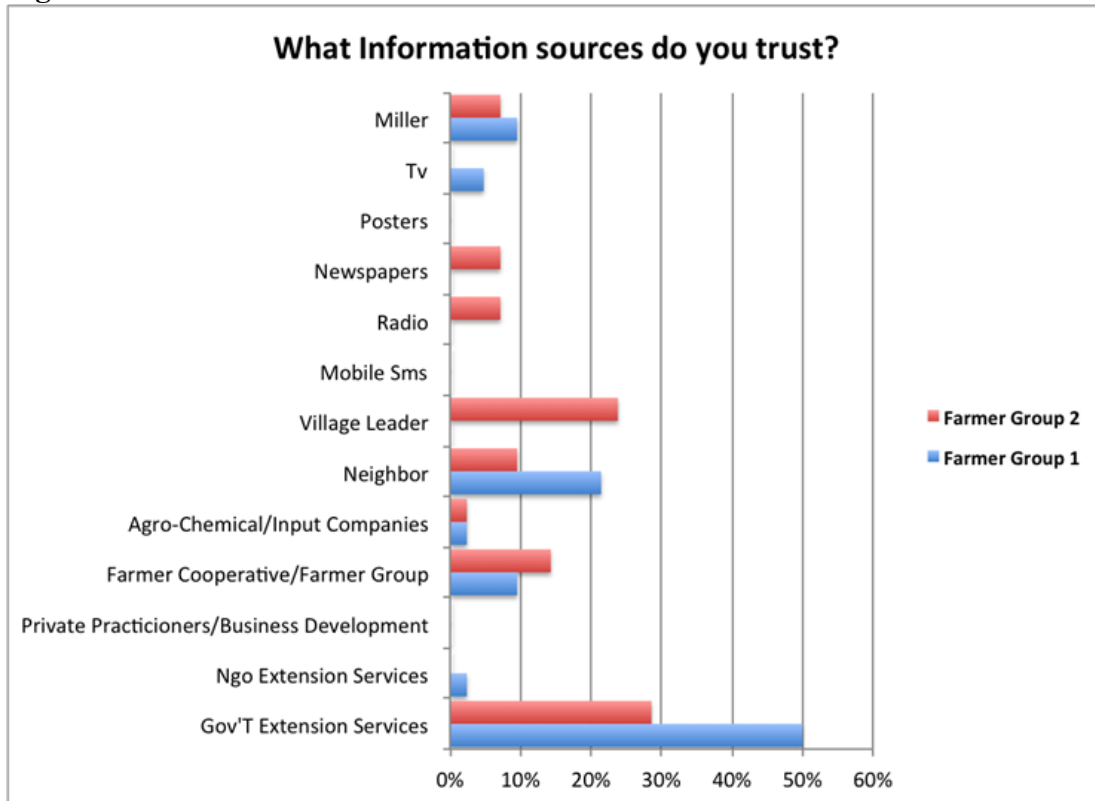
Figure 7:

Finance Information	Farmer Group 1	Farmer Group 2
Avg total household annual income (\$USD)	\$7,143	\$9,769
Avg off-farm income (\$USD)	\$3,415	\$2,826
Avg growing cost per ha (\$USD)	\$511	N/A
Avg labor bill per crop (\$USD)	\$109	N/A
Avg household debt (\$USD)	\$3569.23 (n=26; 13 have no debt)	\$15,465
# Interviewees with savings	10 (38%)	15 (79%)
Average savings (\$USD)	N/A	\$6,340

Access to information (FG 1)

Research indicates that providing market linkages to smallholder farmers improves incomes and decreases poverty. Access to information is a key proxy for farmer engagement in the supply chain and can help determine the strength of market linkages. To measure this, the team asked farmers where they obtained information and which sources of information they trust. FG1 reported that they obtained pricing information predominantly from the miller, followed by their neighbors and government extension services. The following bar graph demonstrates that over 20% of both farmer groups trust government extension workers the most, followed by the village leader (FG2) and neighbors (FG1). Neither group trusts media sources, highlighting the importance of having agronomists and technical assistance providers ingrained in the community. In addition, farmers want their buyer to provide information on best practices, prices, and quality standards, which presents an opportunity for Kellogg and its partners to provide transparency in the value chain.

Figure 8:



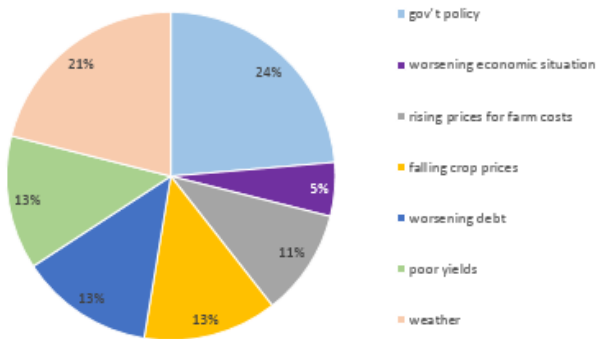
The only source of information both groups trust is the government extension services; in second place are the village leaders and neighbors. There is not much trust on any type of telecommunications for either group, highlighting the importance of working with partners that have staff on the ground and get to know the community to a certain point.

Farmer Concerns

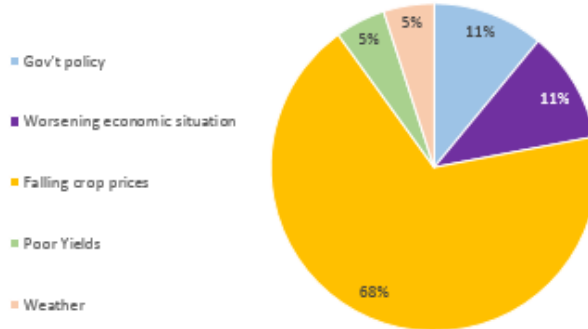
The most worrisome aspects for both groups of farmers are government policy and falling crop prices; however, the strong majority (68%) of FG 2 selected falling crop prices as their number one concern. This is likely a result of recent government changes and new policies taking hold. Given that FG 1 was dependent on the government rice prices, their concept of “policy” likely represents the price at which rice is bought more than legislation. As expected FG 1 cares more about the weather than FG 2, this could simply be accredited to the access to water of each sample.

Figure 9:

FG 1: What was your greatest worry this past year?



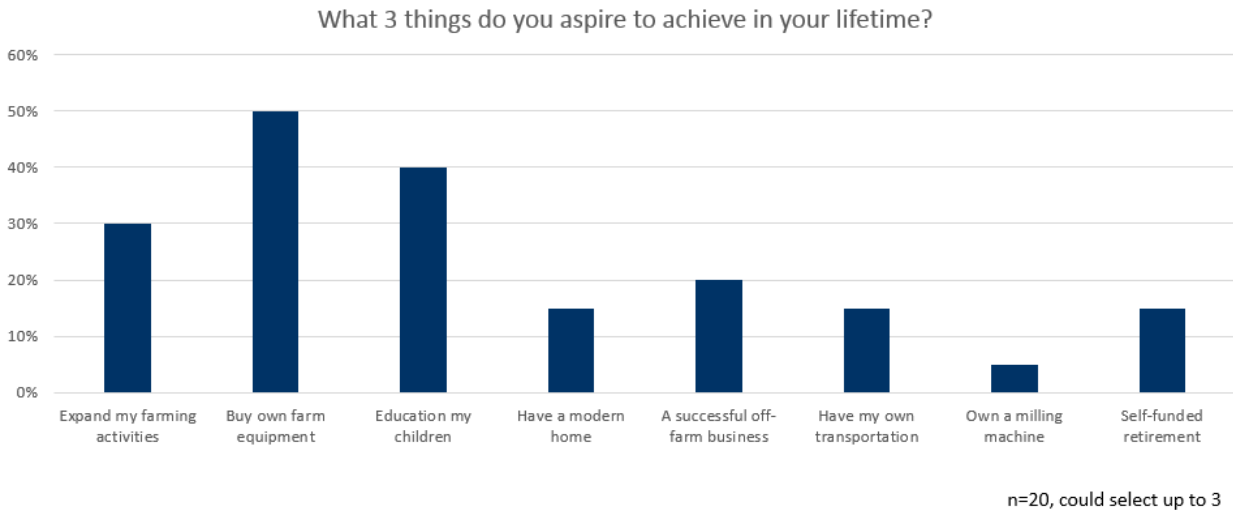
FG 2: What was your greatest worry this past year?



Perceptions of farming as viable future

A commonly used farm-level metric to measure positive social impact is perception that their target crop provides a viable livelihood for future generations. When asked what top three aspirations farmers hoped to achieve (FG1), 50% stated buying their own farm equipment, followed closely by “educate my children.” The takeaway here is that farmer priorities are set around obtaining resources to improve their productive practices and creating off-farm opportunities for themselves and their children.

Figure 10:



Environmental Indicator Impact and Analysis

Rice is the world’s second most produced crop and is important to the livelihood and nutrition of people around the world. Its production has significant impacts on the environment. In fact, rice production is one of the largest human created sources of the greenhouse gas, methane.⁴⁵ In addition, rice production uses 34-43% of the world’s irrigation water.⁴⁶ The inefficient application of nitrogen fertilizers in rice production can also harm water supplies and release another greenhouse gas, nitrous oxide, into the atmosphere. The use of land for rice production can also lead to deforestation. Agronomic training can improve yields, if the training is focused on farmer needs and uses local service providers.⁴⁷ In addition, research shows training is necessary for and can encourage more sustainable farming, but the impact depends on cost and perceived benefits of the farming techniques.⁴⁸

Water management represents one of the most important techniques to reducing water usage and limiting methane emissions from rice production. Alternative wetting and drying, dry seeding, and a single water drawdown during mid-season are all techniques to reduce water use and methane emissions. In order for these techniques to be effective, farmers must have control of irrigation water as well understand and believe in the productivity and cost implications of the water management process.⁴⁹ In FG1, only 43% of the farmers surveyed had access to irrigation, and 38% mentioned suffering from water shortage at some point in the past. In addition, 35% of the growers did nothing to manage their water usage. Many of those surveyed relied on the government to manage the local water supply. All growers surveyed in FG2 had access to irrigation, and when asked, “How do you manage your water usage?”, 35% responded that they control water levels according to rice growing stages rather than leaving their fields entirely submerged.

Maintaining productive soil is another important consideration when working to mitigate the environmental impacts of rice production. Soil testing and applying fertilizer in smaller, more frequent applications reduces loss and maximizes yields. Practices such as planting cover crops and reducing tillage can also increase nutrient efficiency.⁵⁰ The table below lists the methods FG1 and FG2 take to improve the productivity of their soil.

Figure 11:

	Farmer Group 1	Farmer Group 2
How do you improve productivity of soil? <i>% of participants</i>	Organic manure and compost (49%), add more fertilizer (15%), minimum tillage (13%)	Crop management staff (95%), Best practice sharing (79%), Correct seed usage (68%), Field channeling and cover crop training (16%)

Rice farmers indicate that they want information on how to grow medium grain rice in the best way possible, from best practices to correct and timely use of fertilizers and herbicides. Financing via higher price or upfront payment was also mentioned as well as receiving high yielding seeds of a highly priced variety. This can be interpreted as an interest from the farmers to produce as much as possible with the highest quality possible, which parallels Kellogg’s interests of high quality and sustainable farming.

Figure 12:

What services or information would you like to receive from your buyer?	Farmer Group 1	Farmer Group 2
Information on best practices for this variety	30%	36%
Fertilizer and herbicide timing and application	27%	29%
Pricing	32%	11%
Seeds with high yields and prices	5%	14%
Planting instructions	2%	7%
None	2%	4%

Farmer productivity

While farmer yield of both groups is very similar, between 4.3 and 4.6 tonnes per hectare, one key difference is how much is sold to generate income and how much is kept for consumption or seeding. Key distinctions are as follows:

- FG 2 are contracted farmers with the agribusiness, so that they sell the majority of their rice product in exchange for technical assistance received
- The majority of FG 1 produced long-grain and jasmine rice, with only 7 reporting data from the medium grain pilot. In addition, these farmers were benefitting from the government rice price support program, which purchased their rice at 50% above market rate at \$0.44USD/kg. The average price per kilo for FG 2 was \$0.28 USD/kg.
- Only 44% of Farmer Group 1 had access to irrigation whereas 95% of FG 2 did
- FG 1 planted on average 73.1 kilos of medium grain seeds per hectare, while FG 2 planted 41.3 kilos per hectare. Best practices per Kellogg is to plan 50-75 kilos per hectare (8-12 kilos per rai)
- While grain yield indicates the percentage of unbroken rice that farmers are producing for sale, which is the only type Kellogg can use. Proper farming techniques can increase the percentage of unbroken rice to ensure farmers do not waste their crop.

FG 2 is obtaining support to improve its farming practices while FG 1 relies on sporadic visits from the local government agronomist. The *Intervention* column in Figure 13 indicates the type of intervention being provided to achieve continuous improvement in these categories. *Best Practices* includes training in appropriate harvest timing and field preparation for quality control. The agribusiness helps farmers perform soil analysis and nutrient evaluations and provides pre-harvest field inspections. Contract Farming incentivizes farmers to maximize quality yields and provides farmers with a secure income. The agribusiness provides the *Seed Variety* to farmers to help improve the unbroken grain percentage for each crop. *Resource Availability* includes provision of technical assistance, machinery, crop calendars, and financing - all elements that

help farmers be more successful. Finally, understanding the proper *Water Management* is critical for improving the rice crop while mitigating environmental impacts.

Figure 13: Rice Productivity

Metric	Farmer Group 1	Farmer Group 2	Future	Intervention
Average Rice Yield Last Cycle (kg/ha)	4,322 (n=37)	4,606 (n=19)	6,250	Best Practices
Average Revenue from Rice (USD)	\$5,107 (n=27)	\$6,943 (n=19)	\$24,763	Contract Farming
Rice Sold Last Cycle (%)	50%	99%	100%	Contract Farming
Medium Grain Seeds Planted (kg/ha)	11.71 (n=7)	6.6 (n=19)	8	Seed Variety
Whole Grain Yield	40%	53%	68%	Seed Variety
Plantings per Year	1.35	2.3	3	Resource Availability
Irrigation Use (%)	44%	95%	100%	Water Management

*Note - Future will be discussed in the following Cost-Benefit Analysis section.

Modeling: Cost-Benefit Analysis

This section focuses on the outcomes of the interventions program for each stakeholder. We established a base case for each one, and developed 3 different scenarios to better understand the positive and negative changes of the program, as well as the tangible and intangible benefits. The scenarios for both of the stakeholders are:

- **Before** – which portrays not having the program, using the data from the farmers working with the local mill.
- **Present** - having the program as it currently operates, using the data from the farmers in Farmer Group 2
- **Future** - improving the program to reach a realistic but much higher performance with the farmers in Farmer Group 2

The base cases we chose for each stakeholder show the advantages of participating in this supply chain. While some of the interventions also benefit the environment, this CBA does not include any environmental monetization at all given the difficulty around valuing ecosystem services in a developing country, as it is difficult to measure the potential of the land when infrastructure is lacking. Some information in this section has been removed for client confidentiality.

Kellogg Sourcing CBA

The results of this Cost Benefit Analysis outline the value added from sourcing from Thailand, as long as the intervention program is in effect and constantly improved. In this analysis, we projected a specific demand of ready-to-be-manufactured rice (i.e.: post-milling), and we then compared the difference in costs between the base case and each scenario, projecting different sourcing and manufacturing options at each scenario.

For the Kellogg sourcing CBA each scenario takes into consideration the following assumptions:

Scenario	Description	Assumptions
Base Case	All rice is bought from Australia ready to be manufactured	Trade agreements between Thailand and Australia lack a tariff or quota currently.
Past	Using local mill farmer data for production and grain quality	Rice is bought in Thailand, and the quality of the grain yields a 40% milling efficiency, which means buying 2.5 tons to get 1 ton of milled rice.
Present	Using the agribusiness' farmers data for production and grain quality	Rice is bought in Thailand, and the quality of the grain yields a 53% milling efficiency, which means buying 1.9 tons to get 1 ton of milled rice.
Future	Projecting the agribusiness' farmers achievable production and grain quality	Rice is bought in Thailand, and the quality of the grain yields a 60% milling efficiency, which means buying 1.7 tons to get 1 ton of milled rice.

The tangible and intangible benefits taken into consideration for the base case and each scenario are:

- **Tangible**
 - **Possibility of decreasing cost** – From Kellogg's perspective, this is only a possibility when the grain's quality has higher post-milling yields.
 - **Improved farmer's agricultural techniques** – This measures how much more can the farmer produce thanks to participating in Kellogg's intervention program.
 - **Greenhouse Gases decreased** – this is a measure of the reduction of GHGs thanks to Kellogg's agricultural processes requirements, specifically thanks to using Alternate Wet and Drying.
- **Intangible**
 - **Goodwill transferred to farmers** – This benefit is a binary variable that considers that the best practices taught to the farmers for rice growing, can be transferred to other crops improving their yields.

The results are as follows:

The **Base Case** does not provide possibilities for impact given Australia's already industrialized agricultural sector, as well as having market rate prices on which savings are unlikely to happen. These situations make it a good candidate for the base case.

Analyzing the **Before Scenario**, it's clear that buying from smallholding farmers that lack resources and technical assistance is neither cost efficient, nor impact yielding. This was the case with the local mill farmers that despite the intervention plan that was drawn out, the partner was not able to execute it. Despite the different sourcing and manufacturing options, none have a beneficial result for Kellogg.

The **Present Scenario** is what is currently being done in partnership with the agribusiness, which as the numbers show is a good situation for Kellogg as it can result in significant savings depending on the sourcing and manufacturing combination. This scenario already starts to deliver social and environmental impact via tangible and intangible benefits.

Finally, from the **Future Scenario** it can be assessed that as Kellogg bolsters the intervention program and the farmer's production levels increase with improved growing practices, the partnership with the agribusiness results in even greater savings for Kellogg as well as considerable benefits for the farmers and the environment. Moreover, as the regional cereal market develops in the medium and long term, causing demand to increase, there must be a plan on how to provide the same level of technical assistance to any new farmer that joins the supply chain.

Farmer CBA

The results of this analysis outline the value added to the farmers when participating in Kellogg’s intervention program, specifically the potential income increase from higher rice production. In our analysis, we used a minimum wage position in Thailand as the base case, and compared the income and costs generated to 3 scenarios portraying the situation of the farmers before the program, with the current program, and with conservative projected improvements for the farmers.

For Farmer CBA each scenario takes into consideration the following assumptions:

Scenario	Description	Assumptions
Base Case	Minimum wage position, with country mandated salary	Given the adjacency of farming lands where the farmers live, requires transport and possibly lodging, and the uncertainty of jobs, result in “costs” for that individual
Past	Using local mill farmers data for production costs and selling price	This rice was being bought at government subsidy levels (twice the real price) discouraging improved production techniques.
Present	Using current agribusiness farmers data for production and selling price	The rice is bought in agreement with the agribusiness and the farmers are paid fairly, as well as given resources to improve production, and sell more.
Future	Projecting agribusiness farmers production levels and grain quality, as well as costs and selling price	The rice is bought in agreement with the agribusiness and the farmers are paid fairly, as well as given resources to improve production even more.

From this CBA analysis it can be concluded that in the **Base Case** situation, earning a minimum wage position can be desirable for some individuals. Nevertheless, the costs associated with that position and the actual availability and real candidacy of the farmers is questionable. Using the established rate for these costs is small enough to make it a better income producing option than poorly managed farming.

For a correct interpretation of the **Before Scenario**, it’s important to highlight that the data comes from 2013, when the government rice program paid double the market price for rice, and that many of the of the farms surveyed had off-farm income. The excess payments and the farmers’ ability to make money in other ways resulted in farmers keeping half of their rice production for consumption and seeds, and not investing into better production practices or resources.

The **Present Scenario** shows how the current farmers in the intervention program are able to produce more rice, thanks to higher yields and increased crop production per year, which can be attributed in part to water availability in that region. Nevertheless, this farmers have a 23% increase in yearly profit compared to the base case. This income increase can improve attachment to the program and long-term commitment to Kellogg’s supply chain.

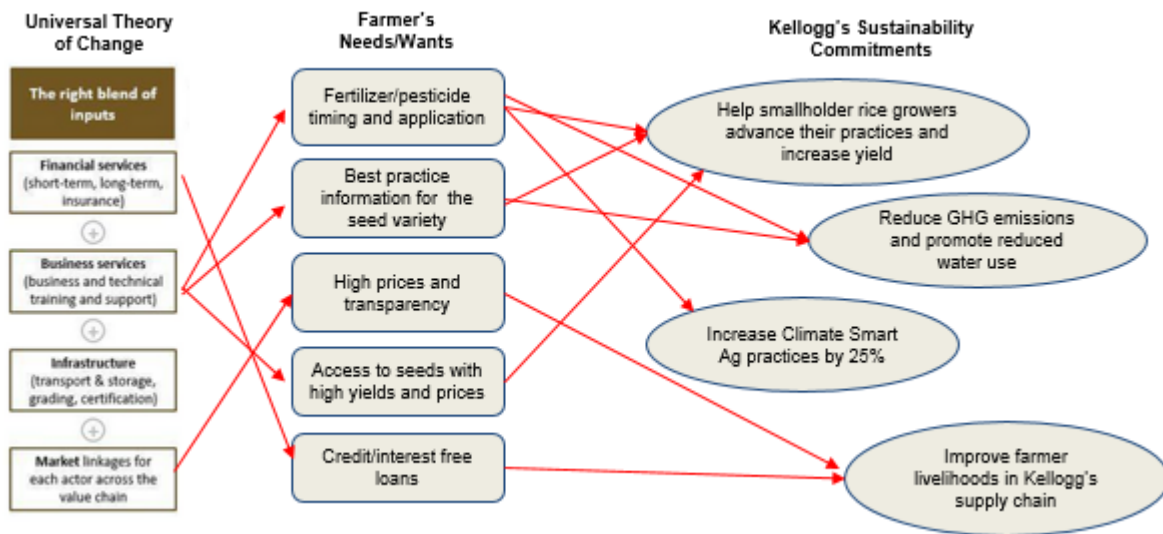
Finally, the **Future Scenario** shows an attainable increase in yearly profit for a farming household of 57% when compared to the minimum wage situation. The production improvements established are taken from the lower ranges of best practice production levels, making it a conservative scenario. Moreover, if the intervention program can achieve these and higher improvements to the lives of the farmer population, Kellogg will ensure the following generations remain farming and not pursuing other professions in urban areas.

Opportunity for Impact

Materiality Assessment

To determine the key priorities throughout this study, the team plotted the key inputs necessary for the universal theory of change, the items that farmers said they wanted/needed, and Kellogg’s sustainability commitments. Farmers were asked both “What information, technology, or resources would be most helpful to increase your yield?” and “What information would you like to receive from your buyer?” The results of this exercise, seen in Figure 14, determined what aspects and interventions are relevant to analyze further and where Kellogg should prioritize allocating resources to create the largest impact.

Figure 14



Recommendations

After reviewing the results of the materiality assessment described above, the team recommends Kellogg focus on the following four areas in order to create a viable source of medium grain rice to support the manufacturing of Kellogg products in the Asia Pacific region, assist its rice farmers in improving their livelihoods, and reduce the impacts of rice production on the environment. Several of the following recommendations can also be applied to Kellogg's work in other emerging markets.

First, it is critical that as Kellogg involve its agronomy team at the start of projects to develop new production sources and supply chains. The agronomy team should be responsible for ensuring the local context and realities on the ground match project priorities. Specifically, the agronomy team should ensure that farmers have the necessary inputs to produce a viable crop, including agronomic knowledge, business and technical support, physical supplies, and financial services. Kellogg's agronomy team is in a unique position to understand the limitations and challenges its producers face and create supply chains that mitigate these issues. Therefore, the team recommends that Kellogg's agronomy team complete a formal assessment on new agricultural supply chains before significant resources are devoted to developing these commodity sources.

Next, Kellogg must address water management challenges to ensure a secure supply of medium grain rice. Access to water and proper water management facilitates higher rice yields, ensures farmers have a stable income, and can decrease the greenhouse gas emissions associated with rice production. In the short term, the team recommends Kellogg ensure its producers have physical and financial access to the necessary water for medium grain rice production. Over the long-term, the team recommends Kellogg implement producer training on water saving production techniques such as Alternate Wetting and Drying (AWD). Proper implementation of AWD will reduce water use and greenhouse gas emissions without negatively impacting rice yields.

To assist Kellogg in reaching its goal of increasing Climate Smart Agriculture practices by 25%, the team recommends Kellogg regularly survey its medium grain growers in order to design site specific best practice programs to train farmers, resulting in higher yields and improved rice quality. As the skills of its producer base develop, the environment changes, and technology evolves, accurate data will ensure Kellogg has the necessary information to address challenges in its supply chain. The team advises Kellogg to develop a regular survey schedule with its growers.

Finally, developing a secure sourcing supply requires a triple bottom line approach. The team recommends that it is in Kellogg's long-term interest to design and implement agricultural interventions that maximize value to its business, its producers, and the environment in which they work. Research shows that providing technical assistance on sustainable farming best practices provided in tandem with financial services, educational trainings, and access to information and markets can show producers that farming is a viable livelihood for them and their children. In conclusion, medium grain rice production in Thailand holds great potential to reduce risk in Kellogg's rice supply chain, reducing costs over time while providing guaranteed revenue generation for thousands of smallholder farmers.

APPENDIX

Appendix A: Thailand Farmer Survey Questions

Question	Answer Choice
Name	
Nickname	
What is your gender?	Female; Male
Age	
Are you participating in the Kellogg pilot for medium grain rice?	Yes; No
Are you a(n)	a: Owner farmer; Rented farmer; Lease Farmer; Farmer
How many years have you: owned the farm/ is your lease/ work for the same individual?	
Is anyone in your household a member of a farmer group or cooperative?	Yes; No
If yes, which one(s)?	
If no, is there a farmer group or cooperative you would like to join?	
What does success mean to you?	
Which has been your best production year and why was that (i.e. what does successful mean)?	
How do you measure profitability?	Yield per rai; dollars per rai; margin
Total rai on farm (per type of ownership)	
How many rai of rice do you grow?	
How long (in years) have you grown rice?	
How did learn to farm?	
Have you grown anything different in the past?	Yes; No
What was your yield in kg per rai for your last growing cycle per crop?	
What would have helped you to grow more?	
How much did you sell from your last growing cycle per crop? (in kg)	
What price did you receive for your production last growing cycle per crop? (in baht)	
Were you satisfied with the price you received from your crop last year?	Yes; I'm not sure; No
How do you decide how much to sell your rice/corn for?	
How do you access pricing information?	a. Gov't extension services; b. NGO extension services; c. Private practitioners/business development; d. farmer cooperative/farmer group; e. agro-chemical/input
Are you satisfied with the access to pricing information that you have?	Yes; No
Tell us about any government extensions you use for farming?	
Where do you sell your crop?	
Does the mill have specifications about the rice that you sell?	Yes; No
Is there any incentive to improve quality?	
What % of last year's rice/corn harvest was rejected or sold at a reduced price?	
What does contract growing mean to you?	
Do you contract grow?	Yes; No
Why or why not?	
If so how much? (in ha)	
Why not?	
Would you consider contract growing?	
To whom do you contract?	a. Broker / village head; b. cooperative; c. mill; d. food
How long are contract terms? (in months)	
How long have you worked with this mill? (in years)	
Do you expect that your relationship with the mill will continue for a long time?	Yes; No
Why yes or no?	
What services or information would you like to receive from your buyer?	
What is the biggest determinant of when you harvest?	needing money; when crops are mature; because of the weather; available transportation or storage; need to plant
If other	
For next year, do you think your crop will be:	a. better; b. the same; c. worse
And why?	
What technical assistance access do you have to help you grow your crop?	
Are you satisfied with your access to technical assistance?	Yes; Neutral; Not
In the last production year, how many times did you receive training or advice from an extension worker/agronomist?	
What was the advice?	
Where did you get it?	
What information, technology, or resources would be most helpful in improving your crops and yields?	

What would be the biggest challenge for you in growing medium grain rice?	
What would be most important/helpful to you if you were to grow medium grain rice (education, technology, inputs)?	
What are your main costs in producing rice/corn?	labor; pesticides/herbicides; fertilizer; land; water; seeds;
How much money per rai per crop did you spend on these items per cycle?	
Are there any other inputs to running your farm (gasoline, electricity)?	Yes; No
If yes, what and how much does that cost per crop cycle?	
How many rice crops do you grow per year?	
Do you have access to credit?	Yes; No
What are the terms (length)? The interest rate?	
How do you select which variety you grow (i.e. how do you make an informed choice)?	
Where do you buy your seeds from (i.e. how do you ensure they are high quality)?	
Do you think your seed is high quality?	Yes; No
Where do you store your crops?	
Do you wish you had additional storage options?	Yes; No
What type?	
How many seeds do you plant per rai?	
Do you change your crops from planting season to season to improve your soil (ie. use crop rotation)?	Yes; No
How?	
What is your rotation plan per cycle? (Interviewer, write season #: # ha of crop)	
Do you consider yourself at risk from weather variations (e.g. floods, droughts, etc)?	Yes; No
Do you use irrigation?	Yes; No
How do you source your water for irrigation	a. Aquifer/bore; b. river/lake; c. man made dam; d.
What is your water irrigation method?	a. flood; b. channel irrigation
Do you ever suffer from water shortage?	Yes; No
How do you manage your water usage?	
Are any of your crop inputs provided on credit? (by bank? by middleman?)	
Do you apply fertilizer?	Yes; No
If yes, what kind?	
How many times per crop?	
How much fertilizer do you apply (in kg/rai)?	
What is the ratio of nutrients (N:P:K) in each application? (Interviewer: put the ratio separated by " : " i.e.: 16:20:0, 15:15:15...)	
How much fertilizer do you apply per ha of rice grown? UNITS of N	
How much fertilizer do you apply per ha/acre of corn/rice grown? UNITS of P	
How much fertilizer do you apply per ha/acre of corn/rice grown? UNITS of K	
Do you know how much fertilizer to use?	Yes; No
If 100% equals the ideal amount of fertilizer that you would like to use, what % of that amount were you able to use last year?	less than 25%; 25-49%; 50-74%; 75-99%; 100%
Where do you get your fertilizer?	
How do you decide how much nutrients to add each crop cycle?	
How do you improve the productivity of your soil?	Minimum tillage to preserve structure; add more fertilizer; retain or return crop residues to the field to uphold long-term organic matter level in the soil; organic manure and
Do you conduct soil tests?	Yes; No
If yes, how often and which tests?	
How do you control for pests?	
Where do you get your pesticides?	
Are you satisfied with this access you have to pesticides?	Yes; No
Where do you get your herbicides?	
Are you satisfied with this access you have to herbicides?	Yes; No
Have you received safe application training for herbicides/pesticides?	Yes; No
If yes, from whom?	
What is your labor bill per crop of rice (inc planting, harvesting, etc)?	
How many non family members did you employ last crop cycle?	
How many family members worked on the farm last crop cycle?	
How many of your paid workers are women?	
How many family members who work on the farm are women?	

Who does most of the work on the rice crop, such as weeding, harvesting, etc?	Mainly men from the family; mainly women in the family;
What is your household income? (per year)	
Do you have off-farm income? If yes, how much?	
Do you have any outstanding debt?	Yes; No
If yes, how much?	
Do you have savings?	
Who makes the decisions about investing in the corn/rice crop (spending on fertilizer, planting new bushes, etc)	a. Man, but consulted his wife before decision was made; b. women but consulted her husband before deciding; c. man,
Do you have children?	Yes; No
Of your male children ages 5-12, what percentage attends school regularly (more than 80% of the time)?	less than 25%; 25-49%; 50-74%; 75-99%; 100%
Of your female children ages 5-12, what percentage attends school regularly (more than 80% of the time)?	less than 25%; 25-49%; 50-74%; 75-99%; 100%
What is the highest grade your over 12 children have completed?	
What is the highest grade that the male spouse has completed?	
What is the highest grade that the female spouse has completed?	
How many bedrooms does your household have?	
Do you have electricity?	Yes; No
If no, what do you use for lighting?	
What is the main source of lighting fuel for the household?	a. collected firewood, purchased firewood, grass, dry cell torch; b. paraffin, candles, biogas; c. electricity, solar, or gas
Under normal, non-intervention conditions, was there ever financial stress on your family? (getting at food security)	Yes; No
If yes, how often did this happen?	Often/frequently; sometimes; rarely
Under intervention conditions, was there financial stress on your family?	Yes; No
If yes, how often did this happen?	1) Often/frequently; 2) Sometimes; 3) Rarely
Do you level your land prior to planting? Why or why not?	
Do you use animals for crop management?	
Do you know what cereal is?	Yes; No
Do you know what your rice is used for?	
Did you ever have to eat the same foods daily because you did not have other types of food in the house?	Yes; No
If yes, how often did this happen?; sometimes; rarely	Often/frequently
Did you ever serve yourself or any other adult in your household less food because you did not have enough food in the house?	Yes; NO
If yes, how often did this happen?	Often/frequently; sometimes; rarely
Did you ever miss any meals because you did not have enough food in the house?	Yes; No
If yes, how often did this happen?; sometimes; rarely	Often/frequently
Did you ever eat less than you felt you should because you did not have enough food in the house?	Yes; No
If yes, how often did this happen?; sometimes; rarely	Often/frequently
Were you ever hungry and did not eat because you did not have enough food in the house?	Yes; No
If yes, how often did this happen?; sometimes; rarely	Often/frequently
Did you or a member of your family ever lose weight because you did not have enough food in the house?	Yes; No
If yes, how often did this happen?	Often/frequently; sometimes, rarely
Did you or another adult in your household ever not eat for an entire day because you did not have enough food in the house?	Yes; No
If yes, how often did this happen?; sometimes; rarely	Often/frequently
Have you worried about the following risks in the past year?	government policy; worsening economic situation, rising prices for farm costs; falling crop prices; worsening debt; poor yields; weather; community relationships, insufficient
Which is the biggest worry (only choose one)?	government policy; worsening economic situation, rising prices for farm costs; falling crop prices; worsening debt; poor yields; weather; community relationships, insufficient
Which of the following have you tried to find information on?	Fertilizer use; recommended seed variety; soil conservation measures; planting methods; prices for farm products; places
Which of the following were you successful in finding information on?	Fertilizer use; recommended seed variety; soil conservation measures; planting methods; prices for farm products; places

How did you get this information?	a. Gov't extension services, b. NGO extension service; c. private practitioners/business development service; d. farmer cooperative; e. agro-chemical/Input company; f.
Which of these sources of information do you trust?	a. Gov't extension services, b. NGO extension service; c. private practitioners/business development service; d. farmer cooperative; e. agro-chemical/Input company; f.
What three things do you aspire to achieve in your life?	Expand my farming activities; buy own farm equipment; educate my children; have a modern home; a successful off-farm business; have my own transportation; able to contract
Do you have a smartphone? (Note: this question was added late)	
Interviewer to answer: Were there any special circumstances about this interview?	

Appendix B: Full Potential Intervention chart

Name of Intervention	Affordability	Ease of Implementation	Yield Impact
A- Best Practice Sharing	Medium	Medium	High
B- Recordkeeping	High	Medium	Medium
C- Mobile Phone Updates	High	Medium	Medium
D- Crop Management Staff	Low	Low	High
E- Dual tillage	Low	Medium	Low
F- Laser Leveling	Low	Low	Medium
G- Correct seed usage	High	High	Medium
H- Field channeling	Low	Low	High
I - Apply AWD	Medium	Low	High
J- Regular Soil Testing	Low	Medium	High
K- Individual Nutrient Management Plan	Medium	Low	High
L- Site Specific Nutrient Management	Low	Low	High
M- Cover Crop Training	Medium	Medium	Medium
N- Application Training	High	High	Medium
O- Safety Equipment	Medium	Low	Low

Appendix C: Full Interview Data Set Farmer Survey 1

See Separate Attachment

Farmer Survey 2

See Separate Attachment

Local Mill survey

1 - Date Collected	5/13/14 0:15
2 - Date Sent	5/13/14 0:19
3 - Duration (seconds)	0
4 - User	kelloggsteam
5 - How many tonnes per year of rice come through the mill?	
6 - How many employees do you have?	
7 - How many of these employees are women?	
8 - How many years has the mill been in operation?	
9 - What are biggest costs of operating? How much are your annual expenses?	
10 - What are your annual revenues?	
11 - From how far away do you source?	
12 - How can farmers increase their yield/productivity per rai?	
13 - How many different rice varieties come through the mill?	
14 - Who are your main competitors? What is your market share?	
15 - What do you see as the biggest obstacle to farmers in growing medium grain rice?	

16 - What is your biggest obstacle in a medium grain rice supply chain?	
17 - What services do you traditionally offer farmers? What do you think you'll need to offer them with medium grain rice?	
18 - Do you contract grow for other rice varieties besides medium grain?	
19 - What are the contract terms for the medium grain rice pilot?	
20 - What are the main rice specifications that you require?	
21 - Who do you sell to? How much?	
22 - What are the main ways the intervention has affected you?	
23 - What % of individual farmers do you work with as opposed to aggregators/middle men?	
24 - Do you own the trucks that transport the rice? Where does the rice go from here?	
25 - What can Kellogg do to ensure the medium grain rice effort is successful?	
26 - How do you measure a successful year?	

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