



Diversifying for Resilience in Vietnam

Minh and Trang grow rice on two hectares (five acres) of land in the **Mekong River Delta** in Vietnam. Their two children, ages 8 and 12, attend school and help their parents cultivate the rice fields. Like many people in Vietnam, rice provides two-thirds of their family's daily calorie consumption, and they rely upon it for cash income as well.

In recent years, Minh and Trang have struggled with the declining productivity of their rice as the salinity of the water has increased in the river delta region. Like their farming neighbors, they incorporate shrimp production alongside their rice fields, helping them earn more income. But they continue to face environmental challenges to their farming operations from flooding, drought and increasingly polluted water sources.



CLIMATE CHALLENGES IN THE RICE BOWL

The Mekong River flows through the vast **Mekong River Basin (MRB)**, which includes parts of China, Myanmar, Laos, Thailand, Cambodia and Vietnam. More than 70 million people live in the MRB and rely on the Mekong River for drinking water, agriculture and transportation.

The Mekong River empties into the **Mekong River Delta** spanning 13 provinces in southern Vietnam.

The river delta is home to 19 percent of Vietnam's population (17.5 million people) and produces 57 percent of the country's rice and 41 percent of its aquaculture products.¹ Farmers in this region also grow fruit and other agricultural products, making it the breadbasket and rice bowl of Vietnam.

Vietnam is now the world's second largest rice exporter after Thailand, and the river delta is key to this success story; 90 percent of all exported rice from Vietnam comes from the Mekong River Delta.² But rice and agricultural productivity are threatened by changes in climate and shifting weather patterns.

With its flat terrain averaging less than one meter above sea level, this region is vulnerable to encroaching salt water from the surrounding sea. Since 1985, the sea water level has risen by an average of three millimeters annually, spreading further inland and impacting a wider area each year.

Rainfall levels are also increasing and timing of the rains is shifting. Farmers must now adjust their growing practices to account for the decreased rainfall at the start of the rainy season and higher rainfall amounts at the end of the rainy season.³

Upstream dams in the Mekong River Basin, coupled with changing ocean temperatures in the Pacific due to El Niño–Southern Oscillation (ENSO, an irregular periodical variation in winds and sea surface temperatures), contribute to higher salinity and drought in other sections of the delta. Taken together, these shifts threaten the region's food security and environmental sustainability. Farmers and food producers must adopt new practices and innovative technologies to adapt and survive.

PRODUCTIVE RICE FARMS BEAT CLIMATE CHANGE

The **International Rice Research Institute (IRRI)** and **DuPont Pioneer** conducted research in partnership to develop a commercial Pioneer® brand rice hybrid seed (PHB71) that prospers in soil with higher salinity.

Bringing together a female rice parent line developed at IRRI's research center in the Philippines with a male parent line developed by Pioneer has resulted in a hybrid with improved roots, rigorous growth to make it through a shortened growing season and yields that are 30 to 40 percent higher than seeds that self-pollinate in open fields (open-pollinated varieties, or OPVs). These enhanced seeds are also proven to be more resistant than local varieties to diseases such as bacterial leaf blight and leaf blast.

Agronomic training helps farmers effectively incorporate these improved hybrids into their regular farming practices and to receive the most value from them. In Vietnam, the **Thanh Hoa Province Department of Agriculture and Rural Development** has partnered with **DuPont Pioneer** to establish a **Rice Model Farm Program** where farmers learn about seed selection, management of soil



Farmers in Vietnam learn about optimal rice spacing and planting and sustainable rice farming practices at the Rice Model Farm.

health, pests, water and nutrients and sustainable farming practices to improve productivity. They also are trained in postharvest storage strategies to prevent losses.

As part of the model farm program, farmers grow the hybrid seeds side by side with their local varieties to test and learn together about their advantages. PHB71 has been proven to help farmers across many countries in southeast Asia who face similar soil salinity challenges from rising sea levels.

The Vietnamese government is providing new options for farmers to improve their agricultural practices and grow diverse, higher-value crops. While they face risks by adopting new practices, Minh and Trang know they must bolster their farm's resilience in the face of climate change and shifting market demands.

Trang has decided to focus on improving the productivity of her rice fields and is working to produce higher quality rice. In addition, she and Minh adopted a rice-shrimp rotation system promoted by the government in 2000, enabling them to double their annual income.

In the rice-shrimp system, shrimp are raised during the dry season (February to June) and rice is grown in the rainy season (August to December). Trang relies on wet season rainfall to flush the salinity from the soil during the period between harvesting the shrimp and planting the rice.

Since 2010, higher temperatures and shifting rain patterns have increased the salinity of her soil, reducing the yields of her rice. Recently, Trang learned of a new rice seed developed through a public-private partnership that grows more effectively in saline soils, and she is receiving training on how to incorporate this rice variety through a rice model farm training program.



Catching shrimp in a rice-shrimp field in Vietnam. Photo credit: Kam Suan Pheng, 2011. WorldFish



NURSERIES CULTIVATE HARDY SHRIMP

In addition to boosting their rice productivity, Trang and Minh have benefitted from public-private partnerships to improve the quality of their shrimp production.

In Vietnam, 90 to 95 percent of the area under shrimp production and 65 percent of production volume originate with small-scale farmers like Trang and Minh.⁴ The future of shrimp production in Vietnam depends heavily on fostering their knowledge and use of best practices to boost sustainable productivity.

The Vietnamese shrimp industry must improve the quality of shrimp stock available for farmers and train them to select good quality post-larvae shrimp for their growing operations. Accessing better quality shrimp and protecting them during the vulnerable early growth stage will result in healthier, hardier, better-quality shrimp, bringing producers higher prices with less wasted feed and water resources.

Trang participated in a training course on how to select high-quality post-larvae shrimp and how to construct a shrimp nursery where young shrimp can be fed with approved nutritious starter feed. This boost in the early stage of their life cycle helps shrimp grow more quickly to full weight and size, as well as become more resilient to sudden water stresses from salinity or temperature changes.⁵

The training was sponsored by the **United States Agency for International Development (USAID)**

BETTER RICE FOR BETTER NUTRITION

In Vietnam, rice is the main food for millions of poor people. Rice provides caloric energy but is deficient in micro-nutrients such as iron, vitamin A, iodine and zinc, putting them at risk for devastating diseases and even death.

Globally, as many as **19 million pregnant women are vitamin A deficient (VAD), along with 250 million pre-school age children.** An estimated 250,000 to 500,000 of these children become blind every year, half of them dying within 12 months of losing their sight.⁶

To improve rice quality while maintaining high yields, plant breeders and agronomists from governmental and international research agencies are collaborating to develop biofortified rice (varieties with higher levels of iron, zinc and

beta-carotene for vitamin A) through breeding and through genetic modification.⁷

Small-scale farmers can grow, sell and consume this higher-value rice while earning more income and improving their nutrition. These rice varieties can be marketed through regular commercial outlets and will benefit low-income, rice-dependent people.

The International Rice Research Institute (IRRI) is the coordinating institution for research centered upon improving the nutritional content of rice through biofortification.⁸ IRRI coordinates the research for **Golden Rice**, in which rice is biofortified by transferring genetic material from corn and a common soil microorganism into the rice plant so that the plant contains beta-carotene. The body converts beta-carotene in Golden Rice to vitamin A as it is needed. Daily consumption of one

cup of Golden Rice could supply 50 percent of the Recommended Daily Allowance of vitamin A for an adult.

Studies to date show that food and livestock feed derived from biofortified rice is as safe and nutritious as that derived from conventional rice varieties.

Improving diets through diverse food consumption, vitamin and mineral supplements and food processing can help people suffering from micronutrient deficiencies, but these interventions have ongoing costs and industrial processing may not be readily available in developing countries.

Biofortification is a sustainable solution because the new and improved seeds can be available through government or commercial markets, enabling farmers to continue doing what they do best: cultivate and harvest improved, high-quality rice.



Vietnamese farmer, Huynh Van Hue, enjoys a successful corn harvest.

CORN FEEDS VIETNAM

Corn is already the second largest crop in Vietnam after rice, yet **the country still imports between five and seven million tons of corn each year to feed livestock** for growing consumer protein demand.⁹

With little additional land available for production, farmers must improve corn productivity on existing land to seize the market opportunity to supply livestock feed.

Better production practices and better seeds are needed. As part of **Monsanto Vietnam's** sustainable development efforts, more than 200,000 farmers have received training since 2015 on good agronomic practices and hybrid corn seed selection. Seeds with beneficial traits improved through conventional breeding and advanced biotechnology are now becoming available for many farmers in Vietnam.

High-yielding improved corn seeds such as DEKALB® hybrids and stacked trait biotechnology (seeds engineered for both insect protection and herbicide tolerance) help farmers grow more while requiring less labor to remove weeds and apply crop protection. The improved corn is particularly resilient against three harmful pests: asian corn borer, common cutworm and corn earworm.

To help farmers make the transition from rice to corn, Monsanto agronomists and rice farmers developed a series of best agronomic practices, the **Dekalb® Cultivation Rice-to-Corn Rotation Protocol**, that was selected as a preferred cropping system by the **Vietnamese Ministry of Agriculture and Rural Development**. Farmers in pilot programs used this protocol across several departments of Vietnam and increased their incomes by up to 400 percent while supplying more corn for livestock feed. New jobs and businesses such as corn drying and feed mill development are becoming part of the growing corn value chain.

The Ministry has set a goal of transitioning 668,000 hectares of rice-growing land to corn production in the northern region of Vietnam by 2020. Farmers in other regions of the country are also being supported as they diversify to more resilient, high-value crops and livestock while sustainably intensifying rice production in the most suitable areas.

and tested as part of a pilot project by local organizations including the **Vietnam Red Cross**. Aspects of the initial pilot project will now be shared across five provinces in the Mekong Delta, covering 250,000 hectares of rice-shrimp farmland and benefitting one million people who rely on this system for their income.

FROM RICE TO CORN: DIVERSIFYING FOR RESILIENCE

While rice consumption and rice farming is culturally important across Southeast Asia, some farmers can no longer earn enough income from rice farming to support their families. At the same time, the demand for corn across the region, including Vietnam, is soaring.

Vietnamese Ministry of Agriculture and Rural Development (MARD) policy encourages production of high quality and specialty rice where land is most suitable,

along with support for farmers to transition to different crops, such as corn, on land where rice cultivation is less productive.

Minh noted this rising demand and decided to diversify his farm production to include corn. Taking advantage of government laws that reformed land tenure and improved access to land for small-scale farmers in the south of Vietnam after 1993, he now rents two additional hectares of land from a neighbor in his village who no longer wishes to cultivate rice. Minh uses government-approved agronomic protocols disseminated through training workshops to make the shift to corn production on this land.

Minh and Trang are further diversifying by planting salt-tolerant trees (guava, papaya and mangrove) along the banks of their rice fields and shrimp ponds to provide additional food and income, while stabilizing soil and, in the case of mangroves, helping filter water. Diversification to corn, shrimp and fruit trees has increased their incomes while also diversifying their own diets.



Policies to Improve Productivity and Sustainability in Vietnam

The Vietnamese government began modernizing its agriculture sector in the 1980s, focusing on reducing food insecurity and poverty. In 1990, 45 percent of Vietnamese people were undernourished, compared with 11 percent in 2015, a significant achievement in the wake of war and reconstruction.

According to the **Global Food Security Index**, Vietnam has improved food security by implementing nutrition standards, establishing food safety net programs for vulnerable populations and increasing access to finance for farmers. The government has also helped reduce food loss and the proportion of the population in poverty, while stabilizing the “booms and busts” of agricultural production.¹⁰

Much of this success has been driven by sound government policies and investments in the agriculture sector. Since 1986, the government policy (“Doi Moi” or socialist-oriented market economy) has reformed the collective model of agriculture, recognizing farming families as the main units of agricultural production instead of cooperatives and state farms. Land reform after 1988 allowed farmers to lease land for up to 20 years. Vietnam rapidly moved from insufficient levels of rice production to become the world’s second largest rice exporter today after Thailand.

Further modernization and policy reform will help Vietnam realize its full agricultural potential while improving food security and reducing poverty, particularly for 67 percent of the country’s population who live in rural areas.

Invest in Public R&D and Extension

To achieve high levels of agricultural productivity growth, global development institutions recommend allocating **at least one percent of agricultural gross domestic product (AgGDP) annually to public agricultural R&D** — indeed, this figure has become a key a measure of agricultural research intensity. While the Vietnam government’s agricultural R&D expenditures more than

doubled between 2000 and 2010, **research spending as a percent of agricultural GDP was just 0.18 percent in 2010, among the lowest in the developing world.**¹¹

In June 2014, the government approved the **Agricultural Restructuring Plan (ARP)**, which focuses on increasing the productivity, innovation, diversification and quality of Vietnam’s agricultural products and sector. The ARP invites broader stakeholder participation, especially from national and international private-sector partners, and supports the core institutions that service agriculture.

In light of this strategic shift towards modern agriculture, the Vietnamese government must increase its budget support for R&D and extension to strengthen the resilience of small-scale farmers facing the challenge of climate change.

Embrace Science-Based and Information Technologies

The Vietnam government currently embraces biotechnology to improve resilience of crops to disease and increase yield, particularly for rice and corn, as well as to improve the health of shrimp and fish in aquaculture systems.

A prominent technology being explored is the multiplication of disease-free citrus trees using shoot-tip grafting techniques. With this technique, Vietnamese scientists have created a species of citrus trees tolerant to the citrus greening disease that is devastating citrus crops worldwide.

Innovative technology such as genome-editing is new to Vietnam, but agricultural scientists are interested in these applications, especially to improve rice and cassava in the face of climate change.

Vietnam has in place clear and consistent biosafety laws that provide a legal framework for the safe management of genetically engineered organisms and products.

The government has established intellectual property regulations that protect the rights of plant variety developers.

The Ho Chi Minh City government is seeking investment partnerships to create a high-tech agricultural zone and a biotechnology center that will promote urban agriculture to feed its rising population.

Enhance Private-Sector Involvement in Agriculture and Infrastructure Development

In 2017, Vietnam began significant policy reforms that enhance private-sector involvement in agriculture and infrastructure development. Vietnam mobilizes capital investments from foreign direct sources, governments and international development institutions to augment its own investments in infrastructure and agriculture.

Land reform is a critical step to attract investment capital and, in 2017, land laws continued to liberalize so that farmers and agricultural businesses can achieve economies of scale. Access to credit and financing for agricultural companies and entrepreneurs is becoming further streamlined. New strategic policy guidance by the Ministry of Agriculture also improves collaborations with international agricultural companies and services.

In the Mekong Delta, the government is inviting domestic and foreign investors to explore agricultural business opportunities and is eliminating cumbersome barriers to private-sector partnerships. One such project led by the city of Can Tho seeks a \$26 million investment to build the Thoi Hung High-Tech Agricultural Zone on 500 hectares of land. The facility will produce plant varieties, breed livestock under international standards and apply cutting-edge technology in processing agricultural and aquatic products.

Vietnam also recognizes that foreign investments and partnerships must be mobilized to modernize its irrigation systems and cold-chain infrastructure for agricultural storage and transport to urban areas.

Cultivate Partnerships for Sustainable Agriculture and Improved Nutrition

Vietnam attracts investments and partnerships with international development institutions such as the World Bank, the International Fund for Agricultural Development, The Asian Development Bank, the U.S. Agency for International Development and the government of Japan in order to promote economic development, food security and nutrition. More partnerships to improve the productivity and sustainability of agriculture are needed, particularly with private-sector agriculture and food industries, to address the impact of climate change and to improve the quality and safety of the food produced in Vietnam.

Many private-sector agribusinesses find a stable and reliable partner in the people and government of Vietnam. The government facilitates partnerships for productive value chains in aquaculture, coffee, corn, fruit and rice, along with many other commodities, and provides opportunities to add value and branding opportunities to Vietnamese agriculture.

Foster Capacity for Regional and Global Agricultural Trade

Agriculture and food producers reap greater benefits from their exports when countries facilitate cross-border trade. Reducing bottlenecks at the border also helps reduce food loss and waste. Vietnam's performance in trade facilitation is better than many Asian and other lower-middle income countries. Areas requiring improvement include streamlining of border procedures through automation and modernization of information systems and appeal procedures to allow goods and services to flow in a timely manner.¹²

Vietnam maintains an open and consistently-enforced regional trade approach with its Southeast Asian partners through the **Association of Southeast Asian Nations (ASEAN)**. ASEAN member countries have made significant progress by lowering intra-regional tariffs to less than five percent and have harmonized many standards for food and agriculture products.

With the halt of the regional **Trans-Pacific Partnership (TPP)** trade agreement due to the withdrawal of the United States in 2017, Vietnam now looks to Europe to realize new opportunities for trade. **The EU-Vietnam Free Trade Agreement (EVFTA)** will accelerate trade between Vietnam and individual EU states and is expected to be ratified in 2018. The EVFTA will most likely be the first agreement between EU states and a Southeast Asian nation, allowing Vietnam to serve as the premier entry point to the region for goods and services. Vietnam's export standards must conform to those of the EU for most goods, including food and agricultural products. This will require ongoing improvements in sustainability and food safety.