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Regenerative Agriculture in Myanmar, Thailand, and Viet Nam: Opportunities for U.S. Agribusinesses

Shwe Ye Han

Myanmar Agricultural Fellow

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Executive Summary

Regenerative agriculture is becoming a commercial issue as well as an agronomic one. Farmers in Myanmar, Thailand, and Viet Nam face drought, flooding, salinity, and declining soil fertility, which affect their costs, yields, and incomes as well as the reliability and quality of supply for buyers. At the same time, many large food and agriculture companies are setting emissions targets that depend on changes at farm level, some trade rules are raising traceability requirements, and governments across the region are supporting improved practices through national programs and financing.

This report assesses where U.S. agribusinesses could contribute to selected farming systems: Delta rice and Dry Zone pulses and oilseeds in Myanmar; irrigated and rainfed rice and northern rice–potato rotations in Thailand; and Mekong Delta rice and Central Highlands coffee in Viet Nam. It draws on a desk review conducted from August 2025 through September 2026.

Key findings

- **Myanmar** has clear agronomic needs but the most constrained operating environment. Dry Zone farms face poor soil nutrition and competing uses for crop residues, while salinity limits water management in parts of the Delta. Field trials show that alternate wetting and drying can improve water productivity and cut emissions. Declining credit use and security conditions, however, limit farmer purchases and service delivery.
- **Thailand** offers the most developed delivery channels. The Thai Rice GCF project combines farmer incentives and a THB 5 billion (about USD 150 million) loan facility with training, and national systems for monitoring rice emissions are expanding. U.S. food and agriculture companies are already partners in rice and potato programs. Opportunities center on machinery, water management, input advice, straw management, and potato supply chains.
- **Viet Nam** has the largest government-led program. Its low-emission rice program covered about 355,000 hectares by early 2026, and pilot models reported lower seed, fertilizer, and water use alongside higher yields and profits. Coffee systems in the Central Highlands need better irrigation scheduling, soil improvement, and support for plantation renewal, while EU traceability rules add pressure on coffee exporters.

Recommendations for U.S. agribusinesses

1. **Match entry points to existing delivery channels.** Use local input businesses and machinery contractors in Myanmar, government finance programs and processor partnerships in Thailand, and cooperatives, mills, and extension partnerships in Viet Nam.
2. **Offer services built around connected farm operations.** Combine equipment, inputs, and advice where one practice depends on another, such as planting through residues alongside weed and nutrient management.
3. **Link digital and monitoring services to real operational needs,** building on Thailand's and Viet Nam's national rice data systems rather than creating parallel ones.
4. **Use sourcing relationships to support farm-level changes** where improved quality or reliability justifies buyer investment.

Table of Contents

Executive Summary	1
List of Abbreviations	3
1. Introduction.....	4
2. Regenerative Agriculture and Business Relevance.....	5
2.1 Concept and Scope.....	5
2.2 Why Regenerative Agriculture Matters for Business	5
2.3 Policy Frameworks and Implementation Mechanisms	6
2.4 Implications for the Country Assessments	10
3. Methods.....	11
4. Myanmar	12
4.1 Agricultural Context and Selected Crop Systems.....	12
4.2 Climate and Natural Resource Pressures	13
4.3 Regenerative Agriculture Practices and Supporting Evidence	14
4.4 Implications for U.S. Agribusinesses.....	16
5. Thailand	20
5.1 Agricultural Context and Selected Crop Systems.....	20
5.2 Climate and Natural Resource Pressures	21
5.3 Regenerative Agriculture Practices and Supporting Evidence	22
5.4 Implications for U.S. Agribusinesses.....	24
6. Viet Nam	29
6.1 Agricultural Context and Selected Crop Systems.....	29
6.2 Climate and Natural Resource Pressures	30
6.3 Regenerative Agriculture Practices and Supporting Evidence	31
6.4 Implications for U.S. Agribusinesses.....	34
7. Cross-country Comparison and Recommendations	39
7.1 Priorities Across the Selected Farming Systems	39
7.2 Recommendations for U.S. Agribusinesses.....	40
References.....	42

List of Abbreviations

ACIAR	Australian Centre for International Agricultural Research
AMAF	ASEAN Ministers on Agriculture and Forestry
ASEAN	Association of Southeast Asian Nations
BAAC	Bank for Agriculture and Agricultural Cooperatives
BCG	Boston Consulting Group
ERIA	Economic Research Institute for ASEAN and East Asia
EU	European Union
FAF	Food, Agriculture and Forestry
FLAG	Forest, Land and Agriculture
GCF	Green Climate Fund
GDP	Gross domestic product
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GPS	Global Positioning System
IRRI	International Rice Research Institute
JIRCAS	Japan International Research Center for Agricultural Sciences
MADB	Myanma Agricultural Development Bank
MMK	Myanmar kyat
MRV	Measurement, reporting, and verification
NAMA	Nationally Appropriate Mitigation Action
SBTi	Science Based Targets initiative
THB	Thai baht
USABC	U.S.-ASEAN Business Council
USDA	U.S. Department of Agriculture
VND	Vietnamese dong

1. Introduction

Agricultural resilience and commercial performance are closely linked. For farmers, keeping soils productive, managing water, and sustaining yields shape both costs and incomes. For agribusinesses, the same factors affect demand for products and services, the reliability of supply, and the quality of the crops they buy. Regenerative agriculture offers a way to examine where better farm management could serve both goals. The topic is also gaining policy attention in the region: ASEAN's Food, Agriculture and Forestry Sectoral Plan 2026–2030 includes regenerative measures among its priorities (ASEAN, 2025a).

This report examines potential opportunities for U.S. agribusinesses in selected farming systems in Myanmar, Thailand, and Viet Nam. It asks three questions: which production constraints create a need for improved practices; what evidence supports those practices under local conditions; and where U.S. firms could contribute through products, services, or sourcing partnerships. The aim is to identify practical areas for commercial engagement and to inform discussions with potential partners.

The three countries share rice-based agricultural economies and similar climate pressures, but they differ in market conditions. Thailand and Viet Nam are major agricultural exporters with active government programs on climate-smart and low-emission rice. Myanmar has substantial agricultural potential but a more constrained operating environment. Together, they allow comparison of how similar agronomic challenges translate into different commercial opportunities.

The scope covers Delta rice and Dry Zone pulses and oilseeds in Myanmar; irrigated and rainfed rice, together with northern rice–potato rotations, in Thailand; and Mekong Delta rice and Central Highlands coffee in Viet Nam. These systems offer distinct settings for examining water management, soil fertility, crop diversification, and the links between farm production and value chains.

The report first sets out the concept of regenerative agriculture, its business relevance, and the policy frameworks that support it, followed by the methods. Three country chapters then examine each selected system in turn, and a final chapter compares findings across countries and presents recommendations.

2. Regenerative Agriculture and Business Relevance

2.1 Concept and Scope

Regenerative agriculture connects agricultural production with the restoration of soil health, improved water management, and stronger ecological functioning. Definitions differ in the weight they give to farming practices and intended environmental outcomes (Newton et al., 2020). This report uses the term to describe locally adapted management intended to improve the natural resources supporting production while keeping farms productive and economically viable. The analysis focuses on water management, balanced nutrition, crop residues, and diversification in the selected farming systems of Myanmar, Thailand, and Viet Nam. It treats regenerative agriculture as a commercial question as well as an agronomic one: whether improved practices can create value for farmers and the businesses that supply, finance, and buy from them.

2.2 Why Regenerative Agriculture Matters for Business

For U.S. agribusinesses, the relevance of regenerative agriculture rests on five commercial drivers: supply reliability, farm economics, buyers' emissions targets, market-access requirements, and public financing for agricultural investment. These drivers can support demand for inputs, machinery, monitoring, testing, and sourcing services.

Supply reliability. The country chapters document drought, flooding, salinity intrusion, and declining groundwater in the selected production areas. For buyers and processors, these pressures create risks to supply volume, quality, and price. Practices that maintain soil condition and improve water management can help manage that exposure. Existing corporate partnerships illustrate business participation in this area. Mars and PepsiCo, for example, are private-sector partners in Thailand's climate-smart rice program, which targets more than 253,000 rice farmers (The Nation Thailand, 2025).

Farm economics. Improvements in returns provide an important incentive for farmers to adopt new practices. Results from pilot models supported by IRRI under Viet Nam's one-million-hectare low-emission rice program showed reductions in seed use of 45 percent, fertilizer use of 30 percent, and irrigation water use of 20 percent, alongside a 12 percent increase in yields and an average profit gain of VND 6 million (about USD 230) per hectare per crop (IRRI, 2026). These are reported pilot results rather than estimates for every farm participating in the program. Earlier survey evidence found that adopters of "One Must Do, Five Reductions" had approximately 10 percent lower production costs and 10 percent higher profits than conventional producers (Tho et al., 2021).

The transition can nevertheless require substantial investment. BCG's modelling of wheat farms in Kansas estimated that profits could decline by 60 percent or more during the initial transition before reaching 70–120 percent higher profitability once practices became established (Bugas et al., 2023). These estimates are specific to the modelled U.S. production system, but they illustrate why financing, technical support, and purchasing arrangements can matter during a transition.

Buyers' emissions targets. Companies setting targets under the Science Based Targets initiative's framework must establish separate forest, land and agriculture (FLAG) targets when its sectoral criteria apply. Relevant food production, processing, and retail sectors are covered by this requirement, which also includes a no-deforestation commitment (SBTi, n.d.). PepsiCo, for example, has an SBTi-validated target to reduce its Scope 3 FLAG emissions by 30 percent by 2030 from a 2022 baseline (PepsiCo, n.d.). For businesses purchasing agricultural commodities, supplier engagement and changes in sourcing practices are important routes for addressing these emissions.

Rice is particularly relevant because rice cropping systems account for approximately 8–11 percent of global anthropogenic methane emissions (Mehla et al., 2026). Corporate commitments also indicate the scale of business interest. PepsiCo aims to spread regenerative, restorative, or protective practices across 10 million acres by 2030, while ADM reported engaging more than 56,000 farmers across approximately 4.6 million acres in 2025 (ADM, 2026; PepsiCo, 2025c). These commitments provide potential markets for agronomic services, agricultural technologies, and measurement systems that document farm-level outcomes.

Market access. Production information is also becoming relevant to market access. The EU Deforestation Regulation, which covers coffee, is scheduled to apply from 30 December 2026 for large and medium operators (Council of the European Union, 2025). This matters for Vietnamese coffee exporters serving the EU. Europe more broadly accounted for 47.2 percent of Viet Nam's coffee export volume in the 2024/25 crop year, although that figure should not be interpreted as the EU's share alone (VietNamNet, 2025). The regulation concerns deforestation, while regenerative agriculture addresses a broader set of farming outcomes; traceability and farm-data systems can support both objectives.

In rice, IRRI reported that more than 18,000 hectares had been certified under the "Vietnam Green Low-Emission Rice" label launched by the Vietnam Rice Industry Association, alongside the first export of 500 tons of certified low-emission rice to Japan (IRRI, 2026). Such initiatives illustrate how documented production standards can become part of product differentiation and sourcing relationships.

Public finance. Agricultural credit and incentive programs can help farmers and cooperatives invest in equipment and practices. In Thailand and Viet Nam, some mechanisms explicitly support climate-smart, organic, or circular production. Subsidies can lower adoption costs, while credit can help spread expenditure over time. These mechanisms are relevant to suppliers because they can improve eligible customers' capacity to invest.

2.3 Policy Frameworks and Implementation Mechanisms

Regional frameworks. The **ASEAN Food, Agriculture and Forestry Sectoral Plan 2026–2030**, adopted by ASEAN agriculture ministers in October 2025 as the medium-term framework for implementing the ASEAN FAF Vision 2045, provides the principal regional reference (ASEAN, 2025a, 2025b). Its first strategic thrust, "Promoting Sustainable and Regenerative Measures," identifies soil nutrient management, mechanization, digital technologies, and agricultural waste recovery as priorities. It also proposes affordable credit, agricultural research investment, and

alignment with the agriculture criteria of the ASEAN Taxonomy for Sustainable Finance. Its fifth thrust addresses public–private partnerships, agricultural cooperatives, contract farming, precision agriculture, and digital platforms for market access and traceability (ASEAN, 2025a). Version 4 of the taxonomy, released in November 2025, added technical screening criteria for agriculture, forestry, and fishing (ASEAN Taxonomy Board, 2025).

The sectoral plan also promotes the **ASEAN Guidelines on Promoting Responsible Investment in Food, Agriculture and Forestry** as a reference for investment partnerships. These guidelines address inclusive investment, community engagement, and fair contracting with farmers and cooperatives (ASEAN, 2018, 2025a). Together, the instruments identify both investment priorities and arrangements through which businesses can participate.

ASEAN ministers have explicitly recognized business participation in this agenda. Their 2025 meeting highlighted regenerative agriculture as a key strategy for soil health, ecosystem restoration, biodiversity, and climate resilience. It also acknowledged USABC's contribution to private-sector engagement and investment and encouraged broader partnerships to implement regional priorities (ASEAN, 2025b).

Work on more specific implementation instruments continued in 2026. In April, the ASEAN Secretariat and ERIA co-hosted consultations on an implementation plan for regenerative and resilient agriculture and separate guidelines for biochar production and application. A second consultation followed in June, involving government representatives, research organizations, financial institutions, and the private sector (JIRCAS, 2026a, 2026b). These consultations illustrate a channel for technical contributions to regional policy development.

Two earlier instruments identify additional activities. The **Action Plan for Sustainable Agriculture in ASEAN**, adopted in October 2024, supports implementation of the regional guidelines adopted in 2022 and lists national projects with objectives, outputs, stakeholders, and timelines (ASEAN, 2022, 2024a). Viet Nam's entries include emissions measurement, reporting, and verification (MRV) and carbon-credit pilots intended to engage the private sector. Myanmar's entry proposes a Rice Bio-Park using rice biomass and by-products for food, feed, and other products (ASEAN, 2024a). The **ASEAN Guidelines on the Reduction of Crop Burning** promote residue incorporation, feed use, biochar, and machinery for residue collection, alongside partnerships to commercialize residue-management technologies (ASEAN, 2024b). These activities correspond to the residue-handling and monitoring services considered in the country chapters.

National mechanisms. Regional frameworks establish shared priorities, while national programs and financing arrangements shape implementation. The following mechanisms are particularly relevant to the selected farming systems.

In **Myanmar**, government reporting described increases in Myanmar Agricultural Development Bank seasonal loans from May 2026, with the annual interest rate unchanged at 5 percent. Loans for paddy, wheat, and long-staple cotton for seed production rose from MMK 150,000 to MMK 300,000 (about USD 34 to USD 69) per acre, those for 18 other crops from MMK 100,000 to MMK 250,000 (about USD 23 to USD 57), and those for sesame, canola, and jute from MMK

100,000 to MMK 150,000 (about USD 23 to USD 34). The reporting also described machinery loans at 6 percent for equipment ranging from power tillers and irrigation pumps to dryers, silos, and rice mills (Myanmar Digital News, 2026a). In August 2026, farmers participating in government-supported rice export zones in the Nay Pyi Taw Council Area received cultivation finance and seeders at an event hosted at a Myanmar Agribusiness Public Corporation facility (Myanmar Digital News, 2026b). These measures provide potential channels for agricultural equipment and inputs, although their reach must be considered alongside the credit and security constraints discussed in the Myanmar chapter (Hnin Ei Win & Minten, 2026).

In **Thailand**, the Thai Rice GCF project connects finance directly with climate-smart practices. A package launched by BAAC and GIZ on 29 January 2026 combines approximately THB 300 million (about USD 9 million) in incentives for around 40,000 farmers with a THB 5 billion (about USD 150 million) preferential loan facility. Incentives range from THB 500 to THB 1,600 (about USD 15 to USD 48) per rai (1 rai = 0.16 hectares) for up to ten rai per household. Loan eligibility requires approved training in climate-smart technologies and in investment planning and financial management (GIZ, 2026). This creates a defined route through which eligible farmers can finance changes in cultivation and technology use.

Separately, The Nation Thailand (2026) reported that the production subcommittee under the national rice policy mechanism outlined a Premium Rice proposal in February 2026. Its reported targets included 700,000 tons of low-carbon rice and 300,000 tons of organic rice, with support of THB 500 per rai for low-carbon production. This indicates a further policy direction, although the cited report does not establish final approval or disbursement status.

In **Viet Nam**, the one-million-hectare program establishes targets for high-quality, low-emission rice in the Mekong Delta by 2030, including emissions reductions exceeding 10 percent relative to traditional practices and the collection and reuse of rice straw (Viet Nam Government News, 2023). IRRI reported that program coverage had reached 354,839 hectares by early 2026, compared with an initial target of 180,000 hectares (IRRI, 2026).

Decree No. 156/2025/NĐ-CP, effective from July 2025, provides a complementary credit mechanism. It allows credit institutions to consider unsecured lending of up to 70 percent of project or business-plan value for eligible organic agriculture activities or agricultural activities meeting circular-economy criteria. It also raises the unsecured lending ceiling for cooperatives and cooperative unions to VND 5 billion, or about USD 195,000 (Government of Viet Nam, 2025). Eligibility follows the decree's criteria and lender assessment, so describing an activity as regenerative does not automatically qualify it.

Viet Nam's emissions trading system has a pilot phase covering 2025–2028, initially applying to thermal power, iron and steel, and cement production. The framework also permits eligible domestic and international offset credits. Potential revenue from rice projects therefore depends on approved crediting methodologies, verification, registration, and buyer demand, and should not be assumed in commercial planning (International Carbon Action Partnership, 2026).

Table 1 summarizes the regional and national mechanisms discussed in this section.

Table 1*Policy Mechanisms Relevant to Regenerative Agriculture and Business Participation*

Mechanism	Level and status	Main mechanism	Relevance to U.S. agribusinesses
ASEAN FAF Sectoral Plan 2026–2030	ASEAN; adopted October 2025	Regional priorities for regenerative practices, finance, technology, cooperatives, and partnerships	Direction for technology development, services, and public–private cooperation
47th AMAF Joint Press Statement	ASEAN; October 2025	Ministerial support for regenerative agriculture and recognition of private-sector participation	Basis for engagement with ASEAN implementing bodies
Regenerative and resilient agriculture implementation plan; separate biochar guidelines	ASEAN; consultations documented in April and June 2026	Development of implementation priorities and technical guidance	Technical contributions through consultation and partnership processes
ASEAN Taxonomy for Sustainable Finance, Version 4	ASEAN Taxonomy Board; November 2025	Technical screening criteria covering agriculture, forestry, and fishing	Reference for assessing sustainable investment activities
Action Plan for Sustainable Agriculture in ASEAN	ASEAN; adopted October 2024	National project entries, stakeholders, resource requirements, and timelines	Potential project and implementing-agency connections
ASEAN Guidelines on the Reduction of Crop Burning	ASEAN; 2024	Residue alternatives, collection technologies, and commercialization partnerships	Residue-handling machinery, processing, and technical services
MADB agricultural and machinery loans	Myanmar; loan expansion announced May 2026	Higher per-acre crop loans at 5%, including MMK 300,000 for paddy; machinery loans at 6%	Financing relevant to equipment and input purchases
Rice export-zone cultivation support	Myanmar; support documented in Nay Pyi Taw in August 2026	Cultivation finance and seeders for participating farmers	Potential channel for production inputs and equipment
Thai Rice GCF financial package	Thailand; launched January 29, 2026	Approximately THB 300 million in incentives and THB 5 billion in loans	Financing for eligible climate-smart investments
Premium Rice proposal	Thailand; outlined by the production	Reported low-carbon and organic rice targets and farmer support	Potential future demand, subject to

Mechanism	Level and status	Main mechanism	Relevance to U.S. agribusinesses
	subcommittee in February 2026		confirmed implementation
One-million-hectare low-emission rice program	Viet Nam; 2023–2030	Defined production areas and targets for cultivation, emissions, and straw reuse	Inputs, machinery, residue services, MRV, and sourcing
Decree No. 156/2025/ND-CP	Viet Nam; effective July 2025	Unsecured lending provisions for eligible organic and circular agriculture and cooperatives	Financing for qualifying farm and cooperative investments
Emissions trading and offset framework	Viet Nam; pilot phase 2025–2028	Industrial compliance obligations and use of eligible offset credits	Potential services for project development, monitoring, and verification

Note: Policy developments reviewed through September 2026.

2.4 Implications for the Country Assessments

These commercial drivers and policy mechanisms provide the basis for assessing regenerative agriculture in this report. Buyers seek reliable supplies and documented production outcomes. Farmers need practices that improve returns and financing suited to the required investment. Public programs, cooperative arrangements, and sourcing partnerships can connect these interests.

For U.S. agribusinesses, potential roles include supplying inputs, equipment, advice, testing, and data services, alongside purchasing arrangements that support improved production. The country chapters therefore connect each potential offering with a specific production need and an identifiable delivery mechanism, including farmer credit, cooperatives, research partnerships, and buyer programs.

3. Methods

This report is a comparative desk-based review of potential opportunities for U.S. agribusinesses linked to regenerative agriculture in Myanmar, Thailand, and Viet Nam. It draws on peer-reviewed research, government and ASEAN documents, publications from research and development organizations, company disclosures, and some news reporting. No primary data was collected. Sources were selected based on how closely they relate to the chosen farming systems, where and when the research took place, and what type of evidence they provide. Policy and business developments are covered up to September 2026. USD equivalents are approximate and based on September 2026 exchange rates of about THB 33.4, VND 25,600, and MMK 4,350 per USD and USD 1.15 per euro, with the Myanmar market rate used instead of the official rate because it better reflects farmers' purchasing power (Board of Governors of the Federal Reserve System, 2026; The Irrawaddy, 2026). Some older studies are still used because they remain the best available agronomic evidence.

In each country, the report focuses on farming systems that matter commercially, face clear climate and resource pressures, and have enough research behind them. These are rice and Dry Zone pulses and oilseeds in Myanmar; irrigated and rainfed rice and northern potato systems in Thailand; and Mekong Delta rice and Central Highlands coffee in Viet Nam. Most company examples come from members of the U.S.-ASEAN Business Council whose products, services, or activities relate to these systems.

Each country chapter has four parts: agricultural context and selected crop systems; climate and natural resource pressures; regenerative agriculture practices and supporting evidence; and implications for U.S. agribusinesses. The chapters move from the problems farmers face to the evidence on practices that could address them, and then to possible business roles, customers, and delivery channels. Research findings are used to judge agricultural and economic outcomes. Policy documents and company publications show how programs are delivered and what companies can offer. The final comparison looks at differences across the three countries but does not rank them or estimate market size.

The findings depend on what existing studies cover and how they were done. Much of the field evidence comes from single sites, particular seasons, or models, so results may not hold across all production areas. Pest and disease management is not covered in depth, because comparable evidence was not available for all three countries, even though it is an important part of regenerative practice. For Myanmar, current security conditions make it harder to know how well earlier research reflects farming today. As a desk-based review, it provides a foundation for further investigation through field validation and discussions with potential customers and partners.

4. Myanmar

4.1 Agricultural Context and Selected Crop Systems

Myanmar's agricultural landscape encompasses four broad agroecological zones: the Delta, Central Dry Zone, Hills and Mountains, and Coastal areas. Differences in rainfall, terrain, and water availability shape production across these zones. Agricultural output is concentrated in the Delta and Central Dry Zone, while highland areas support maize, tree crops, and horticulture. Rubber and oil palm are prominent in parts of the south (Tun Oo et al., 2023). This diversity makes the choice of farming system important when assessing regenerative agriculture, as practices suited to irrigated lowland fields may have limited relevance to rainfed upland farms.

This section focuses on rice-based agriculture in the Delta and pulse and oilseed production in the Central Dry Zone. These systems combine agricultural importance with distinct management challenges. Rice cultivation provides a setting for examining seasonal water management and opportunities for crop diversification, while Dry Zone farming raises questions about moisture conservation, soil fertility, and the balance between different crops. The comparison allows the report to assess where regenerative practices could address specific production constraints and where U.S. agribusiness products, services, or partnerships might support their adoption.

Rice farming in the Delta follows a pronounced seasonal pattern. Monsoon rainfall supports the main growing season, while summer cultivation depends on irrigation where suitable water is available (Kyaw & Kim, 2025). Within this broader landscape, coastal and inland farms face different conditions. Research in the Ayeyarwady Delta shows that dry-season salinity influences the geographical extent of summer rice cultivation, underscoring the importance of distinguishing between farms with reliable freshwater access and those with more restricted cropping options (Sakai et al., 2021). Accordingly, the chapter considers rice management and potential rice–pulse sequences within specific local conditions rather than treating the Delta as a uniform production area.

In the Central Dry Zone, farming systems include pulses, groundnut, sesame, and sunflower. Crops may be grown sequentially or intercropped, with their timing and duration shaped by rainfall and the moisture retained in the soil (Cornish et al., 2018; Herridge et al., 2019). The presence of several legume and oilseed crops does not necessarily mean that individual farms have a balanced crop mix. Herridge et al. (2019) found that limited diversification exposed farmers to market price fluctuations, while an imbalance between broadleaf crops and cereals contributed to disease and yield problems. These findings make the composition of crop sequences, alongside soil and water management, a relevant focus for the analysis.

The economic conditions facing farmers also influence the feasibility of changing practices. Aung and Minten's (2025) assessment of the 2025 dry season, covering 872 paddy producers, reported rising fertilizer, mechanization, and labor costs alongside a 15 percent decline in farmgate paddy prices compared with the previous dry season. Productivity on farmers' largest rice plots declined, and profitability deteriorated. Although these findings concern dry-season rice and cannot be applied to every farming system, they highlight the importance of affordability and financial returns when evaluating adoption.

The selection of these two systems therefore provides both an agronomic and a commercial focus. Subsequent sections examine the pressures affecting production, the evidence for relevant regenerative practices, and the conditions under which businesses could help farmers adopt them.

4.2 Climate and Natural Resource Pressures

The Delta and Central Dry Zone face different combinations of climate exposure and resource constraints. Delta agriculture is vulnerable to flooding, coastal storms, and seasonal restrictions on freshwater availability, while Dry Zone farming depends on managing variable rainfall within soils that often have limited moisture and nutrient retention (Herridge et al., 2019; Tun Oo et al., 2023). The effects on production depend on when these pressures occur, how they interact, and the resources available to farmers.

For Delta rice farmers, water management involves both periods of excess water and periods when suitable irrigation water is insufficient. Coastal inundation and storm surges add to the risks associated with seasonal rainfall variability (Tun Oo et al., 2023). Kyaw and Kim (2025), using data from 1,115 rice-farming households across 108 townships in their broader Delta study area, found that temperature and rainfall were associated with net revenue differently across seasons. Higher summer temperatures were associated with lower returns, while additional summer rainfall was generally beneficial within the conditions studied. Higher monsoon rainfall, however, was associated with lower returns. These results suggest that annual rainfall totals alone cannot adequately describe the water conditions affecting rice farming; seasonal distribution and crop timing also matter.

Saline intrusion further limits the use of river water in the coastal Delta. Sakai et al. (2021) combined field measurements with Sentinel-2 imagery to examine salinity in the Patheingyi, Ywé, and Pyawbwe rivers. During the study period, saline intrusion extended approximately 80 kilometers inland along the Patheingyi River in March, and the mapped salinity boundary was closely associated with the extent of summer rice cultivation. This historical observation illustrates how water quality can restrict cropping even where irrigation infrastructure exists. The study also noted, drawing on earlier research, that irrigation with saline water can contribute to salt accumulation in soils. Its findings support attention to seasonal water quality, although the mapped boundary cannot be treated as a current limit for the entire Delta.

In the Central Dry Zone, water and nutrient constraints are closely connected. Cornish et al. (2018) analyzed rainfall records from 1951 to 2016 and modeled soil water balance in Magway Region. They found that variable rainfall and low soil water-holding capacity produced marked fluctuations between water deficit and excess. Their analysis also identified fewer but larger rainfall events over the historical period. Water moving below the crop root zone could carry soluble nutrients with it, even where crops subsequently experienced moisture shortages. These findings complement Herridge et al.'s (2019) assessment of widespread nutrient deficiencies and low nutrient inputs in the farming systems they examined. Together, the studies indicate that efforts to conserve moisture need to account for how nutrients are supplied and retained.

Seasonal moisture availability also affects the prospects for additional cropping. Cornish et al. (2018) found greater variability in water availability and yield potential for post-monsoon crops than for 80–90-day monsoon crops. Early planting into a moist soil profile offered better prospects, but the outcome depended on conditions at sowing. This creates an important qualification for diversification: land left fallow after harvest is not necessarily capable of supporting another crop without additional risk. The feasibility of a second crop depends on the remaining moisture, its growth requirements, and the timing of establishment.

Soil management introduces further trade-offs. Herridge et al. (2019) identified cultivation and residue removal for livestock feed as contributors to declining soil organic matter and physical degradation. Retaining more material on fields would therefore need to be considered alongside livestock feed requirements. Likewise, nutrient deficiencies mean that a general reduction in fertilizer use would not necessarily support productive farming. The practical objective is to improve soil condition and nutrient management while maintaining adequate crop nutrition and accounting for competing uses of farm resources.

These findings establish distinct priorities for the assessment of regenerative practices. In the Delta, seasonal freshwater availability, drainage, and salinity determine which changes are feasible. In the Dry Zone, crop choice and timing need to be considered together with moisture retention and nutrient supply. Farm-level practices can contribute to addressing these pressures, but their performance will depend on local conditions and, where necessary, complementary water infrastructure and advisory support.

4.3 Regenerative Agriculture Practices and Supporting Evidence

Crop diversification, improved water management, soil cover, and balanced nutrition offer practical starting points for regenerative agriculture in Myanmar's selected farming systems. Research on these practices provides evidence of potential production and resource-management benefits, although results depend on how practices are combined and adapted to local conditions. In the Dry Zone, for example, moisture conservation needs to be considered alongside crop nutrition and planting decisions. In rice systems, changes in irrigation and organic inputs can affect yields, water use, and greenhouse gas emissions differently across seasons (Cornish et al., 2018; Herridge et al., 2019; Win et al., 2020).

Crop Diversification and Rice–Pulse Sequences

Short-duration pulses could provide an additional crop within suitable rice-based systems. Gumma et al. (2018) mapped seasonal fallows in Myanmar and estimated the share where rainfall or stored soil moisture could potentially support pulse cultivation. Their mapping provides a starting point for investigating possible locations, but establishing a viable crop sequence requires a closer assessment of seasonal conditions. Cornish et al. (2018) found that post-monsoon crop performance in Magway depended strongly on moisture availability and planting time. Although the studies cover different geographical scales and farming conditions, together they show why identifying fallow land and establishing its cropping suitability are separate tasks. For Delta rice–

pulse sequences, the interval after rice harvest, remaining moisture, drainage, and salinity would need to be assessed locally.

In the Dry Zone, diversification also concerns the balance between crops already grown. Herridge et al. (2019) identified a narrow crop mix and an imbalance between broadleaf crops and cereals as weaknesses in existing systems. Cornish et al. (2018), meanwhile, found through modelling that short-duration groundnut intercropped with longer-duration pigeonpea could offer a way to accommodate variable post-monsoon conditions. These findings support examining both crop composition and duration when designing rotations or intercrops. For farmers, the value of these more diverse cropping systems would depend on their suitability for local conditions and their effects on soil condition and farm returns.

Water Management in Rice

Alternate wetting and drying allow field water levels to fall between irrigations rather than maintaining continuous flooding. In a field experiment in Madaya Township, Mandalay Region, Win et al. (2020) found that this approach improved water productivity and reduced the combined global warming potential of methane and nitrous oxide emissions by 46–63 percent compared with continuous flooding. Grain yield did not differ significantly between water treatments in the 2017 dry season and was higher under alternate wetting and drying in the wet season. These results provide evidence from Myanmar, but the experiment was conducted at one site outside the Delta and does not establish the same outcomes across different rice environments.

Applying this evidence to Delta rice requires attention to water control and quality. Sakai et al. (2021) showed that dry-season salinity constrained summer rice cultivation in the coastal Ayeyarwady Delta. Applying alternate wetting and drying in the Delta would require fields with sufficient drainage control and reliable access to freshwater for re-irrigation. The practice could contribute to more efficient rice production in those settings, while its suitability in saline or poorly controlled water environments would require separate assessment (Sakai et al., 2021; Win et al., 2020).

Soil Cover and Reduced Disturbance

Retaining crop residues offers a means of addressing the Dry Zone's soil and moisture constraints. The MyPulses project report summarized research in Magway showing that residue mulching increased plant-available soil water by an average of 17 percent, crop water-use efficiency by 35 percent, and grain yields by 36 percent (Herridge, 2019). These findings complement the broader recommendation by Herridge et al. (2019) to combine residue retention and reduced disturbance with diversification, effective weed control, and adequate nutrition. The evidence therefore supports assessing these practices as a coordinated approach: changing tillage alone would leave other constraints unresolved.

Adoption would depend on how much crop residue farmers can retain without compromising livestock feed supplies, as well as the equipment and labor available for planting through it. Reducing tillage would still require suitable planting methods and effective weed control. The

practical priority is to combine residue retention with tillage practices that conserve soil moisture and fit existing farm operations.

Balanced Nutrition and Legume Inoculation

Nutrient management is an essential part of this approach. Herridge et al. (2019) identified inadequate nutrient supply as a major constraint in Dry Zone cropping, while the MyPulses project examined soil deficiencies and tested fertilizer and rhizobial inoculation treatments for chickpea (Herridge, 2019). Rhizobial inoculants introduce bacteria that can support biological nitrogen fixation in compatible legumes. However, project results were variable and sometimes inconclusive: some sites responded to phosphorus and inoculation, while others did not. Taken together, these findings support recommendations based on soil conditions, crop requirements, and local response trials. They do not establish that inoculants can consistently replace mineral fertilizers.

Organic amendments also need to be evaluated within the wider management system. In the Myanmar rice experiment, manure-related yield responses differed between seasons, demonstrating that benefits could not be assumed to be uniform (Win et al., 2020). Combined with the Dry Zone evidence, this suggests that the practical objective is to improve nutrient supply and use through appropriate combinations of organic materials, fertilizers, and biological inputs. Soil testing and local performance evidence would help farmers select combinations that address nutrient needs and deliver benefits that justify their cost.

The evidence supports adoption based on local production constraints and farm economics. In Delta rice systems, suitable rice–pulse sequences and improved water management would depend on seasonal moisture, salinity, and water control. In the Dry Zone, diversification, residue retention, and nutrient management would need to work together within existing farm operations. Across both systems, adoption would depend on affordable implementation and demonstrated benefits for yields, resource use, and farmer returns. These requirements create potential roles for input suppliers, equipment providers, and agricultural service businesses, discussed in the next section.

4.4 Implications for U.S. Agribusinesses

The practices examined in this section point to potential opportunities for U.S. businesses supplying agricultural inputs, machinery, water-management technologies, and related services, as well as buyers seeking more reliable agricultural supplies. Commercial value would come from helping farmers improve productivity, manage production costs, and use resources more efficiently, while strengthening supply quality and reliability for buyers. The following discussion draws on the evidence reviewed above to connect these opportunities to relevant company capabilities, potential customers, and commercial partnerships.

Agricultural Inputs and Agronomic Services

For U.S. input suppliers, the Dry Zone's nutrient constraints suggest opportunities to combine suitable products with practical agronomic support. Herridge et al. (2019) identified inadequate nutrient supply as a major limitation in these farming systems, while the MyPulses project documented variable responses to phosphorus and rhizobial inoculation (Herridge, 2019). An offering that links locally tested inputs with soil testing and crop-specific advice could help farmers make more effective purchasing decisions. For suppliers, repeat sales would depend on demonstrating that the additional expenditure delivers sufficient improvements in farm returns.

Corteva Agriscience's biological inoculants and nutrient-efficiency products illustrate capabilities relevant to this segment (Corteva Agriscience, 2025). The opportunity would be to identify products suited to the selected crops and soil conditions, establish their performance locally, and support their use through reliable distribution and advice. The mixed inoculation results reported by MyPulses make product selection particularly important: biological inputs would need to demonstrate their value within a balanced nutrient-management program.

Local agricultural businesses could provide a route to customers. Myanma Awba describes activities in crop protection, crop nutrition, seeds, and agricultural services, including a seed portfolio covering pulses and oilseeds and farmer advisory support (Myanma Awba Group, n.d.-a, n.d.-b). A potential arrangement could pair U.S. products or technologies with local distribution, demonstrations, and agronomic services. For the U.S. supplier, the commercial benefit would be access to customers and support for repeat purchases; for the local counterpart, it would be an expanded product offering that meets farmer needs. Awba illustrates the type of counterpart that could be assessed, with any arrangement depending on product fit, commercial terms, and delivery capacity in the target locations.

Rice also offers scope for coordinated input and advisory services. Bayer's DirectAcres approach combines seed, crop protection, machinery access, and digital advice to support direct-seeded rice (Bayer, 2023). Direct seeding is already widespread in Myanmar, predominantly through broadcasting, while row planting remains uncommon (Goeb et al., 2026). The opportunity would therefore center on improving establishment and subsequent crop management through suitable seed, planting services, and coordinated weed and nutrient management. Farmer returns and environmental performance would determine whether such an offering supports wider adoption.

Machinery Sales and Contractor Services

Machinery contractors represent a potential customer group for U.S. equipment suppliers. Drawing on surveys conducted in 2016 and 2017, Belton et al. (2021) found that outsourcing markets enabled farms of different sizes to access machinery for land preparation, harvesting, and threshing. Benefits included more timely operations, labor savings, and reduced grain losses. Although the research describes an earlier period, it demonstrates a delivery model in which equipment owners serve multiple farms, allowing farmers to purchase a service without bearing the cost of machine ownership.

For regenerative agriculture, the commercial opportunity would involve equipment that enables specific improvements in farm management. Suitable planting equipment or attachments could support sowing through retained residues, reduced tillage, or more accurate input placement. John Deere's regional materials describe guidance and precision agriculture technologies that illustrate relevant capabilities (John Deere, 2023). Their suitability would depend on field size, compatibility with existing machinery, operator skills, and the cost of the resulting service.

Equipment sales could be supported by operator training, maintenance, and parts supply. Contractors would need sufficient demand and seasonal utilization to recover their investment, while farmers would need reliable crop establishment and benefits that justify service charges. Demonstrations could help establish both sides of this business case by comparing operating costs, planting quality, residue cover, and input use with existing practices. As the Dry Zone research emphasizes, machinery changes would also need to work alongside effective weed control and nutrient management (Herridge et al., 2019).

Water Management Products and Services

For U.S. water-technology suppliers, rice production presents potential opportunities in measurement equipment, irrigation controls, installation, and technical support. The Madaya experiment demonstrated improved water productivity under alternate wetting and drying, while research in the coastal Ayeyarwady Delta showed how salinity constrained summer rice cultivation (Sakai et al., 2021; Win et al., 2020). These findings suggest that customer needs would vary substantially by location: some farms may benefit from better irrigation scheduling, while others first need reliable information on freshwater availability and quality.

Based on these findings, this report suggests that services supporting alternate wetting and drying would be most viable in locations with reliable freshwater and adequate drainage control. Potential customers could include irrigation operators, farmer groups, and larger farms able to coordinate water management across several fields. A commercial offering could combine water-level or salinity measurements with irrigation advice, equipment maintenance, or recurring monitoring services, with product selection matched to what customers can afford: simple monitoring tools may meet some needs, while more advanced sensors and digital systems would need to deliver enough additional value to cover their cost. Customer value would need to come from measurable benefits such as lower pumping costs, more reliable irrigation decisions, or reduced use of unsuitable water.

Sourcing Partnerships and Supply Reliability

For U.S. agricultural buyers and traders, the business case would center on supply quality, consistency, and procurement costs. Support for suitable farming practices could be commercially useful where it improves the performance of an existing or prospective sourcing relationship. In the Dry Zone, research highlights the importance of coordinating crop selection, moisture management, and nutrition (Cornish et al., 2018; Herridge et al., 2019). A buyer or aggregator could help finance demonstrations and technical assistance where the expected benefits to procurement justify the expenditure.

Cargill's regenerative agriculture programs illustrate how agronomic guidance and financial incentives can be linked to downstream customer demand (Cargill, n.d.-d). This experience provides a reference for structuring sourcing partnerships, although the evidence reviewed does not establish a comparable Cargill purchasing arrangement for rice, pulses, or oilseeds in the Myanmar study areas. A similar model would require an identified buyer, a commercially relevant crop, and purchasing arrangements that provide a reason for both farmers and the buyer to participate.

For buyers, value would come from more consistent crop quality, which could reduce rejection or sorting costs, and from reliable production and delivery, which could improve procurement planning. Farmers would need clear purchasing terms and returns that justify any additional costs or requirements.

Commercial Priorities and Conditions for Expansion

For U.S. businesses, an initial priority would be to identify a defined customer, a capable local counterpart, and an offering that fits prevailing purchasing power. Hnin Ei Win and Minten (2026) reported declining agricultural credit use and continuing security-related constraints on commercialization during the 2025 monsoon season. These conditions affect farmers' ability to purchase inputs, contractors' capacity to invest in equipment, and businesses' ability to deliver services reliably.

Drawing on the evidence in this chapter, this report identifies two starting points. Dry Zone pulses and oilseeds offer a basis for assessing input-and-advice packages and planting services suited to residue retention and reduced tillage. Delta rice offers a basis for assessing improved crop establishment and water-management services where freshwater and drainage conditions permit. A focused commercial pilot could establish farmer demand, distribution and servicing costs, and margins for participating businesses. Expansion would depend on repeat purchases or service use, demonstrated farmer returns, and measurable improvements in the soil or water outcomes that underpin the regenerative agriculture proposition.

5. Thailand

5.1 Agricultural Context and Selected Crop Systems

Thailand's agricultural landscape includes rice-based lowlands, upland field crops and horticulture, and southern plantation systems. Differences in terrain, seasonal rainfall, and irrigation access shape cropping patterns across these areas. The Central Plains support intensive irrigated agriculture, while rainfed farming is prominent in the Northeast. Northern Thailand combines lowland rice with field crops, fruits, and vegetables, and the South supports rubber, oil palm, and other perennial crops (Chainuvati & Athipanan, 2001). Within this broader landscape, this chapter focuses on rice-based systems in the Central Plains and Northeast, with potato-based systems in northern Thailand providing a complementary perspective on agriculture connected to food-processing supply chains.

Rice provides the main focus because of its importance to domestic food consumption and agricultural exports, together with the contrasting production conditions across Thailand. For the 2025/26 marketing year, the U.S. Department of Agriculture forecast Thai rice production at 20.7 million metric tons, domestic consumption at 12.4 million tons, and exports at 7.6 million tons (USDA Foreign Agricultural Service, 2025). Rice occupies roughly half of Thailand's agricultural land and involves approximately 5.2 million farming households (Sowcharoensuk, 2024). The distinction between irrigated and rainfed systems affects cropping intensity, planting decisions, and farmers' ability to manage water during the growing season. Thailand's climate-smart rice initiatives, including the government-backed Thai Rice: Strengthening Climate-Smart Rice Farming Project (2024–2028), also provide a basis for examining changes in water, nutrient, and residue management (GIZ, n.d.).

In the Central Plains, alluvial lowlands and irrigation infrastructure support wet-season rice and, where water supplies permit, additional cropping during the dry season, when rice may be followed by another rice crop or by field crops (Chainuvati & Athipanan, 2001). Nationally, main-season rice is largely rainfed and accounts for about 79 percent of output, while off-season rice depends on irrigation and is concentrated in the central and northern regions (Sowcharoensuk, 2024). These systems provide settings where coordinated irrigation and field management can influence production across the annual cropping cycle.

The Northeast provides a contrasting rice environment, with rainfed systems commonly organized around a single annual crop and more limited control over seasonal water supplies (Chainuvati & Athipanan, 2001; Sowcharoensuk, 2024). Irrigated areas also exist, so the region cannot be treated as uniformly rainfed (Chainuvati & Athipanan, 2001). This distinction helps separate practices that require reliable irrigation from those that must function under rainfall-dependent conditions.

Northern potato farming provides a smaller, complementary focus because it connects seasonal crop management with demand from fresh and processed food markets. Kittipadakul et al. (2016) describe two established production settings: highland areas with double cropping and lowland areas where potatoes are grown as a winter crop after rice. Potato production therefore forms part of a wider annual farming system, with planting schedules and field management linked to preceding and subsequent crops. Particular attention is given to potato production within crop

rotations, including rice–potato sequences where practiced, as these systems allow consideration of how soil preparation, irrigation, drainage, and nutrient management interact across crops.

The selected systems provide three contrasting settings: irrigated rice in the Central Plains, rainfed rice in the Northeast, and northern potato production within seasonal cropping systems. Their differences in water control, crop sequences, and market relationships provide the basis for examining climate and natural resource pressures, the suitability of regenerative practices, and their commercial implications.

5.2 Climate and Natural Resource Pressures

Water shortages and flooding create overlapping pressures on Thailand's agricultural production. The World Bank's *Thailand Country Climate and Development Report* identifies floods, droughts, and other climate hazards as important sources of economic risk for agriculture and other sectors, estimating that the physical impacts of climate change could reduce GDP by 7–14 percent by 2050 without decisive adaptation (World Bank, 2025). Their effects differ across the farming systems selected for this chapter. Irrigated rice depends on the availability and management of stored water, rainfed rice is more directly exposed to rainfall variability and soil moisture deficits, and northern potato production requires growing conditions suited to a relatively short seasonal crop. These differences influence both production reliability and the suitability of changes in farm management.

In the Central Plains, irrigation provides greater control over field water but leaves production dependent on supplies beyond the individual farm. USDA's April 2025 assessment linked the expansion of off-season rice planting to above-average reservoir storage, with off-season area expected to reach about 2.05 million hectares, its highest level in recent years (USDA Foreign Agricultural Service, 2025). This illustrates how water supplies influence planting decisions and cropping intensity. Read alongside the World Bank's assessment of drought and flood risks, it indicates that irrigation access alone does not guarantee reliable production. Farms need sufficient water during dry periods and the capacity to manage excess water during heavy rainfall. For these systems, the relevant constraint is therefore the timing and reliability of water delivery and drainage across the cropping cycle.

In the Northeast, rainfall variability interacts with soils that can provide limited protection against dry periods. Khadka et al. (2024) describe much of the Mun River basin as having sandy loam soils with low fertility and limited capacity to retain water and nutrients. Their modelling projects more severe agricultural drought for 2021–2050 under the climate and land-use scenarios examined, with drought events that currently occur once every 20 years becoming twice as frequent under climate change. These are basin-specific projections rather than uniform forecasts for the entire Northeast, but they demonstrate why rainfall, land use, and soil conditions need to be considered together. For rainfed rice, seasonal rainfall totals alone may not adequately describe the moisture available to crops when it is needed.

Soil salinity adds a further constraint in parts of the Northeast, although its effects vary between fields and seasons. Field investigations in Khon Kaen from 2017 to 2019 found that differences between official soil-salinity classes became evident only during the drought year of 2018, when severe drought also devastated rice yields in some fields (Yang et al., 2022). Rice yields declined with salinity measured directly in the soil rather than with the official classification, and yields varied considerably even at similar salinity levels, suggesting that farm management can reduce salinity damage. This interaction means that low yields in affected areas cannot necessarily be attributed to inadequate fertilizer alone. Water availability, salinity, and nutrient conditions can jointly influence crop performance, making local soil and water assessments important when determining which management changes are appropriate.

Northern potato systems face a different combination of seasonal and field-level constraints. Potatoes are grown mainly as a winter crop, and Kittipadakul et al. (2016) identify the need for cultivars adapted to short-season, warm climates as a major limitation in Thai potato production. Water management is also important: work on crop rotations in Chiang Rai Province highlights the difficulty of managing uneven fields and the need to avoid waterlogging during potato cultivation (Pongputhinan, 2024). In rice–potato sequences, the same land must accommodate crops with different field-water requirements, making drainage and preparation between seasons particularly relevant.

Across the selected systems, the central challenge is to maintain productive soils and reliable crop growth under variable water conditions. For irrigated rice, this places emphasis on water availability and field control; for rainfed rice, on soil moisture, fertility, and locally occurring salinity; and for potatoes, on seasonal suitability, drainage, and field-water management. These pressures provide the basis for assessing regenerative practices according to the production problems they address and the conditions required for successful adoption.

5.3 Regenerative Agriculture Practices and Supporting Evidence

Improved water management, balanced crop nutrition, residue management, and suitable crop rotations offer practical starting points for regenerative agriculture in Thailand's selected farming systems. Their value depends on how they address local production constraints and work together within existing farm operations. Thai research provides evidence of benefits from particular practices, while also showing that results vary with water availability, soil conditions, and season. In rice systems, measures that improve productivity or soil condition can also affect greenhouse gas emissions, making it important to assess these outcomes together.

Water Management in Rice

Alternate wetting and drying allows field water levels to fall between irrigations instead of maintaining continuous flooding. Ruensuk et al. (2021) evaluated this approach with pregerminated broadcast rice in farmers' fields across eight Thai provinces during the wet and dry seasons of 2016. Compared with farmers' existing practices, the study reported reductions in total water use of 5–30 percent and increases in dry-season grain yields of 8–22 percent. Net profits

also rose in both seasons, while total production costs did not differ significantly. Methane emissions declined by 7–83 percent in the dry season, but wet-season reductions occurred at only three of the eight sites. These findings support the practice's potential while showing that emissions benefits are not uniform across seasons and locations.

Adoption requires sufficient control over drainage and reliable access to water for re-irrigation. Prangbang et al. (2020) found favorable climatic conditions for alternate wetting and drying across six Central Plains provinces, but emphasized that irrigation access, drainage, and other local factors determine practical suitability. The approach therefore fits fields where farmers can manage drying and rewetting without exposing crops to damaging water shortages. In rainfed Northeastern systems, the immediate priority would be managing available moisture and crop timing; intermittent drying caused by an unreliable water supply is not equivalent to controlled alternate wetting and drying.

Balanced Nutrition and Field-Specific Management

Nutrient management needs to reflect both soil fertility and the yield that available water can support. In on-farm experiments in Roi Et during 2003–2005, Haefele and Konboon (2009) found that fertilizer responses differed with field position, indigenous nutrient supply, and water conditions. Lower-lying fields had more fertile soils and higher yields than upper and middle fields, and limited water reduced attainable yields in some fields. Their findings support fertilizer advice adapted to individual fields rather than a uniform application rate across rainfed rice systems.

For adoption, this means combining information on soil conditions with farmers' knowledge of field performance and seasonal water availability. The objective is to supply nutrients where they improve crop performance and avoid expenditure that produces little additional return. Within a regenerative approach, fertilizers and organic materials would be selected as complementary tools according to crop needs, while maintaining the adequate nutrition that productive farming requires.

Residue Management and Soil Organic Matter

Returning crop residues to the soil can support organic matter management, but the method of handling rice straw matters. In a field experiment in Khon Kaen, Somboon et al. (2024) compared mineral fertilizer alone with fertilizer combined with either raw rice straw or straw-derived biochar, a carbon-rich material produced by heating biomass under limited oxygen. Both amendments increased grain yield, but their emissions effects differed. Raw straw incorporation increased seasonal methane emissions by 119 percent, whereas biochar reduced them by 43 percent and increased soil total organic carbon relative to fertilizer alone.

These results show why residue management needs to be considered alongside water and nutrient management. The experiment covered one rice-growing season under flooded conditions, so it does not establish the same response across other soils or cropping systems. Biochar adoption would also depend on the cost and availability of straw collection, processing, transport, and application. The practical priority is to identify residue-management methods that maintain soil

resources while delivering acceptable costs and environmental outcomes, rather than assuming that every form of residue return produces the same benefits.

Crop Rotations and Management Across Rice and Potatoes

Northern rice–potato sequences provide an existing basis for examining management across different crops. Kittipadakul et al. (2016) describe lowland potato cultivation as a winter crop following rice, alongside highland production systems. This provides evidence of an established crop sequence, although the sequence itself does not demonstrate improvements in soil health or resource efficiency. Its relevance to regenerative agriculture depends on how soil preparation, nutrient supply, residues, and water are managed across the full annual cycle.

Work in Chiang Rai Province under the Building a Climate Resilient Potato Supply Chain Through a Whole-Farm Approach project illustrates practical efforts to coordinate these operations. Pongputhnan (2024) describes training and demonstrations on GPS land levelling for crop rotations, addressing uneven water distribution and drainage needs. This is particularly relevant when moving between rice and potatoes, which have different field-water requirements. The account documents implementation experience rather than a controlled estimate of yield gains or water savings, but it identifies a concrete management task that can support both crops.

For potato growers, adoption would need to preserve timely planting, suitable drainage, and effective crop establishment. Changes in tillage or residue handling would also need to remain compatible with planting and harvesting operations. The practical objective is to manage the rotation as a connected farming system, with decisions for one crop taking account of their effects on the next.

The evidence supports selecting practices according to the conditions of each farming system. Irrigated rice offers scope for controlled water management combined with appropriate nutrient and straw management. Rainfed rice requires particular attention to the interaction between moisture availability and fertilizer response, while northern potato rotations call for coordinated field preparation and drainage across crops. Farmer costs and returns, operational requirements, and measured soil or water benefits would determine the case for adoption. These requirements also define potential roles for agricultural suppliers, service providers, and buyers, considered in the next section.

5.4 Implications for U.S. Agribusinesses

Thailand's selected rice and potato systems present potential opportunities for U.S. businesses in agricultural inputs, machinery, water-management services, digital monitoring, laboratory testing, and food sourcing. Commercial value would come from improving farm productivity and resource efficiency, reducing operating costs, and strengthening the quality and reliability of agricultural supplies. This section suggests several ways to connect these objectives with products and services that farmers, contractors, and buyers have reasons to purchase. Existing agricultural service

networks, government programs, and partnerships with food processors provide potential channels for delivering these offerings.

Agricultural Inputs and Agronomic Services

For U.S. input suppliers, the opportunity is to combine suitable products with advice that improves purchasing and application decisions. Research in Northeastern rice systems shows that fertilizer responses depend on soil fertility, field position, and water availability (Haefele & Konboon, 2009). This supports a commercial approach in which local distributors and agronomists help farmers select inputs according to field conditions and attainable yields. The value proposition would be better returns from input expenditure, with repeat purchases supported by demonstrated performance.

Corteva Agriscience's biological portfolio includes products intended to support crop performance, resilience, and protection, providing capabilities relevant to this segment (Corteva Agriscience, n.d.-a). For Thailand's rice and potato systems, a potential offering could combine appropriate biological or conventional inputs with field demonstrations and technical support. Product selection would need to account for crop requirements, compatibility with existing practices, and the additional cost to farmers. Within a regenerative approach, the commercial objective would be to improve the effectiveness of crop management while delivering measurable benefits for productivity and resource use.

Potato production offers a related opportunity in planting material and associated agronomic services. Kittipadakul et al. (2016) identify seed quality, cultivar suitability, and disease incidence as important production constraints. For suppliers with relevant capabilities, these needs suggest potential demand for quality planting material, crop-health support, and advice coordinated with processor requirements. A viable offering would need to improve marketable production sufficiently to cover its cost and fit farmers' seasonal planting schedules.

Bayer's Thai crop-protection business provides a further perspective on combining agricultural products with local technical support. Its portfolio focuses on rice, vegetables, and fruit, delivered through a nationwide sales and business-development network (Bayer, n.d.). The company has also introduced a direct-seeded rice system in India, with expansion to the Philippines planned from 2024, designed to reduce water use and greenhouse gas emissions (Bayer, 2023). Thailand's existing rice customer base could make it a candidate for similar offerings. For U.S. suppliers, this illustrates the importance of linking suitable products with distribution and advice that help farmers manage crop-specific problems. A potential offering could combine crop monitoring, appropriate treatments, and application support, with commercial value arising from reduced crop losses and more effective input use. Its contribution to regenerative agriculture would depend on how crop protection is integrated with water, nutrient, and soil management, and on the outcomes achieved.

Machinery and Water-Management Services

Thai experience with land levelling and improved irrigation creates a practical starting point for U.S. equipment and technology suppliers. The Thai Rice NAMA project (2018–2023) included support for agricultural service businesses, while work in Chiang Rai Province has demonstrated

land-levelling technology within crop rotations (IRRI, n.d.-b; Pongputhinan, 2024). These activities point to contractors and organized farmer groups as potential customers for equipment, attachments, operator training, and maintenance services. Contractors could spread investment costs across multiple farms, while farmers would pay for the operations they need. The biochar results discussed in the previous section (Somboon et al., 2024) also suggest a role for straw collection and processing services, where such benefits are confirmed locally and collection, transport, and processing costs allow.

John Deere's regional portfolio includes machinery and precision agriculture technologies, and its Asia contact information identifies dealers in Thailand (John Deere, n.d.-a, n.d.-b). These capabilities could be assessed against demand for accurate field operations and input application. Equipment selection would depend on plot size, compatibility with existing tractors, operator skills, and seasonal utilization. For suppliers and dealers, parts and servicing would support recurring revenue; for contractors, reliable equipment and sufficient bookings would determine investment returns.

Water-management services could complement machinery offerings. The Thai field evidence for alternate wetting and drying supports examining products and advice that help farmers manage irrigation more efficiently, although performance varies by season and location (Ruensuk et al., 2021). Potential offerings include field-water monitoring, irrigation scheduling, and installation or maintenance of suitable controls. Customers would need benefits such as reduced pumping expenditure, lower labor requirements, or more reliable water management. Simple monitoring tools may meet some needs, while digital systems would need to justify their additional cost. For potato rotations, drainage and the transition between crops would be central to the service provided.

Digital Monitoring and Emissions Measurement

Thailand is also developing the data systems needed to document changes in rice cultivation. Under the Thai Rice GCF project, IRRI is expanding the national system for monitoring, reporting, and verifying rice-sector emissions by combining field surveys with drone and satellite data. It is also introducing RiceMoRe, a digital platform for farm-level data collection previously developed with Viet Nam's government (IRRI, 2025). The Rice Department collects field-level data that feeds into national climate reporting, with priority given to water management, straw management, fertilizer use, and soil organic carbon (Global Agriculture, 2026).

These developments create potential roles for U.S. providers of sensors, remote sensing, farm software, and data services. Potential customers include cooperatives, mills, exporters, and program implementers that need reliable records across many farms. Offerings would need to integrate with government systems, reduce the cost of documenting practices, and provide practical benefits such as simpler recordkeeping or more timely advice. Potential carbon revenue would require separate assessment rather than being assumed from participation in improved practices.

Sourcing Partnerships and Supply Reliability

For U.S. food companies, regenerative agriculture can support a commercial sourcing strategy by addressing risks to ingredient availability, quality, and production costs. PepsiCo's work with Thai potato farmers provides a direct connection between farm support and food manufacturing. The company has supported a whole-farm approach that includes alternate wetting and drying in rice, rice–potato–corn rotations, and drip irrigation in potato fields, and reports training more than 3,000 farmers in climate-smart agriculture between 2022 and 2024 (PepsiCo, 2025a). This connects agricultural practices to the supply of potatoes used in its snack business.

Rice offers a similar connection. Mars Food and PepsiCo are among the private sector partners in Thailand's climate-smart rice program, a EUR 118 million (about USD 135 million) initiative running from 2024 to 2028 that targets more than 253,000 rice farmers across 21 provinces (The Nation Thailand, 2025). Mars, whose Ben's Original is among the world's largest rice brands, has also committed USD 20 million to sustainable rice sourcing across its supply regions, including Thailand, with a focus on practices such as alternate wetting and drying (Mars, 2025). For participating buyers, support for farming practices can therefore serve procurement objectives alongside environmental commitments. This creates potential roles for agronomy providers, farmer organizations, mills, and technology suppliers in coordinating production and documenting outcomes across the supply chain.

Cargill offers a potential outlet for rice-milling by-products. The company has operated in Thailand since 1968 and employs about 15,000 people there. Protein is its largest Thai business, run through integrated farm-to-fork supply chains, and animal feed is also part of its Thai portfolio (Cargill, n.d.-a). Protein and feed operations of this scale depend on a steady supply of feed ingredients, and Cargill's aquaculture business already uses rice bran as one such ingredient (Cargill, n.d.-c). Thai rice mills could therefore be assessed as suppliers of bran and other by-products to feed operations, subject to quality specifications, storage life, and transport costs. Such arrangements would add value after harvest rather than change practices in the field.

Laboratory testing could also support these sourcing relationships. Thermo Fisher Scientific has published a method for screening pesticide residues in rice and offers analytical solutions across food-testing applications (Azad & Oulkar, 2019; Thermo Fisher Scientific, n.d.). Mills and exporters supplying buyers with residue specifications could be potential customers for instruments, methods, and training. Test results would confirm product specifications, while evidence of regenerative performance would still require assessment of cultivation practices.

Any sourcing program would need to establish how the proposed changes create value for both farmers and buyers. For buyers, the expected value would be more dependable deliveries and consistent ingredient quality, while farmers would need clear purchasing terms and sufficient returns to sustain participation. Relevant measures could include marketable yield, quality consistency, delivery performance, and production costs. Where customers also require evidence of environmental performance, data collection and verification could become part of the service offering. Their cost would need to be proportionate to the purchasing relationship and the value of the information generated.

Commercial Priorities and Conditions for Expansion

Financing can influence whether farmers and service providers adopt new technologies. In early 2026, Thailand's Bank for Agriculture and Agricultural Cooperatives launched a THB 5.3 billion (about USD 159 million) financial package under the Thai Rice GCF project (Rice News Today, 2026). The package combines a THB 300 million (about USD 9 million) subsidy scheme, with support of THB 500–1,600 (about USD 15–48) per rai, and a THB 5 billion (about USD 150 million) loan program. The loans carry preferential interest rates for farmers who complete approved training in climate-smart technologies. For suppliers, such initiatives make it useful to assess how suitable offerings fit participating farmers' needs and applicable program conditions. Financing support could help address initial costs, while continued use would depend on operational performance and customer returns.

Initial commercial priorities would differ across the selected systems. In irrigated rice areas, equipment and services could focus on field-water control, accurate operations, nutrient management, and practice monitoring linked to the national emissions system. In rainfed Northeastern systems, inputs and advice would need to reflect moisture availability and variable fertilizer responses. Potato systems offer scope for coordinated planting-material, crop-health, irrigation, and drainage services linked to processor demand. Across rice supply chains, laboratory testing and by-product use could support quality assurance and additional value from processing. Expansion would depend on demonstrated farmer benefits, viable margins for suppliers and contractors, and reliable delivery through local partners.

6. Viet Nam

6.1 Agricultural Context and Selected Crop Systems

Viet Nam's agricultural landscape includes rice-based delta systems, upland perennial crops, and fruit and vegetable production. The Mekong and Red River deltas are the country's principal rice-growing areas, while the Central Highlands are a major production area for Robusta coffee and black pepper (Asian Institute of Technology, 2013; ACIAR, 2021). Within this broader agricultural landscape, this chapter focuses on rice-based farming in the Mekong Delta and coffee-based farming in the Central Highlands, with fruit crops considered where they form part of coffee-based production.

The Mekong Delta is central to Viet Nam's rice economy and is characterized by widespread smallholder production. ACIAR (2025) reported that approximately half of the country's rice was produced by 1.5 million small-scale farmers in the region. Flor et al. (2021) also identified the Delta as the source of approximately 90 percent of Viet Nam's rice exports and noted that rice farms typically occupied less than five hectares. Rice cultivation includes both double- and triple-cropping systems. Triple cropping is concentrated in parts of the upper Delta with alluvial soils and access to freshwater canals, while seasonal flooding or limited freshwater availability during the dry season restricts cultivation to two crops in other locations (Johnson et al., 2023).

Rice-based agriculture in the Delta also includes systems that combine crop production with aquaculture. In Dong Thap, Berg et al. (2023) documented farms producing two annual rice crops and one fish crop alongside farms cultivating rice alone under either double- or triple-cropping arrangements. Research in a saline-affected area of the Delta has also documented rice rotated with corn and with shrimp and prawn cultivation in rice fields (Tan et al., 2020). These findings illustrate the range of farming arrangements present within the region's broader rice-based landscape. Farmer groups, traders, input suppliers, and exporters also participate in the organization of rice production and marketing. Flor et al. (2021) described collective production arrangements and contracts linking farmers with commercial buyers, demonstrating the role of coordination beyond individual farms.

In the Central Highlands, coffee-based agriculture is an established smallholder production system, with Robusta coffee and black pepper forming important commercial crops (ACIAR, 2021). Byrareddy et al. (2020) examined coffee production across four major producing provinces—Dak Lak, Dak Nong, Lam Dong, and Gia Lai—using ten cropping years of data from 558 farms. Their study documented irrigation practices and differences in irrigation use across provinces and rainfall conditions, establishing irrigation as an important component of the production systems examined. The provincial names refer to the study's geographical coverage during 2008/2009–2017/2018.

Coffee cultivation includes both monoculture and mixed cropping systems. ACIAR (2021) noted combinations of coffee with black pepper and fruit trees such as durian and avocado. A subsequent ACIAR assessment reported that nearly half of coffee farms in the Central Highlands included at least one intercrop, with combinations also including coffee and cashew (ACIAR, 2026). Coffee-

based farming therefore encompasses a range of perennial crop combinations, and diversification is already an established feature of the regional agricultural landscape.

6.2 Climate and Natural Resource Pressures

Climate and natural resource pressures affect Viet Nam's selected farming systems through different combinations of water availability, soil conditions, and land management. In the Mekong Delta, rice production is exposed to flooding, seasonal freshwater shortages, and saline intrusion, alongside changes in sediment supply and land elevation. Yuen et al. (2021) describe these pressures as interacting outcomes of natural hazards, climate change, and human activities, including water infrastructure development and agricultural intensification. In the Central Highlands, research identifies irrigation demand and seasonal water scarcity as important constraints on coffee production, while recent field assessments document soil degradation in coffee-based systems (ACIAR, 2026; Byrareddy et al., 2020).

For Mekong Delta rice farmers, water availability varies across seasons and locations. Johnson et al. (2023) describe how seasonal flooding limits cultivation in areas outside protective dikes, while coastal areas face restrictions on dry-season cropping because of drought and saline intrusion. Flood protection also changes the movement of water and sediment through agricultural land. Yuen et al. (2021) report that high dikes supporting triple-cropping in parts of the Delta reduce the delivery of nutrient-rich alluvium to fields, citing research in which farms behind low dikes received about 2.5 centimeters of sediment annually compared with 0.5 centimeters behind high dikes, increasing reliance on fertilizers to maintain production. Water infrastructure therefore influences both cropping opportunities and the natural replenishment of soil nutrients.

Saline intrusion is influenced by changes within the river system as well as rising sea levels. Eslami et al. (2019) combined observations and modelling to examine increasing tidal influence and salinity in the Delta's channels. They linked these trends to riverbed deepening associated with reduced upstream sediment supply and downstream sand mining. Tidal amplitude within the Delta was increasing by about 2 centimeters per year, far faster than the 1.2–2 millimeters per year attributable to sea-level rise offshore, leading the authors to conclude that human-driven changes were outpacing the effects of climate change. This evidence places agricultural freshwater constraints within a wider system of river management and sediment transport, extending beyond conditions on individual farms.

Intensive rice cultivation also places pressure on soil and water resources. In a study of 78 farmers in Dong Thap, Berg et al. (2023) compared double-cropped rice, triple-cropped rice, and systems combining two rice crops with fish production. Triple-cropped farms recorded the highest annual rice output but also used the greatest quantities of seed and agrochemicals and had the lowest benefit–cost ratio among the three groups. Farmers associated high dikes and frequent agrochemical use with declining water and rice quality and reduced ecological connectivity. These findings concern the systems surveyed, but demonstrate that greater annual production can coincide with higher resource use and weaker economic efficiency.

In the Central Highlands, heat and prolonged dry conditions interact with dependence on irrigation. USDA's Foreign Agricultural Service reported that high temperatures and drought negatively affected coffee production in the 2023/2024 marketing year, and that the 2024 rainy season arrived late amid above-average temperatures. Its April 2024 field observations found that exposed coffee plants without irrigation appeared water-stressed, while irrigated and shaded fields were generally in better condition. The report also identified falling groundwater levels in some production areas as a long-term challenge for coffee production (USDA Foreign Agricultural Service, 2024).

Water demand differs between production locations and climatic conditions. Byraredddy et al. (2020), analyzing ten cropping years of data from 558 coffee farms, found substantial variation in irrigation volumes across four Central Highlands provinces, with higher applications during dry years. Their modelling showed that irrigation could be reduced by 273–536 liters per tree in average years while maintaining yields above 3,000 kilograms per hectare, indicating that water scarcity can coexist with inefficient application. ACIAR (2021) similarly reported that farmers were irrigating coffee at almost double its physical needs and linked over-irrigation and the proliferation of wells to dry-season water shortages. Together, these studies identify both seasonal supply constraints and existing water-use practices as sources of pressure.

Soil conditions create additional constraints in perennial cropping systems. An ACIAR-supported assessment of 375 Central Highlands farms reported widespread soil acidity, low organic matter despite substantial nutrient inputs, and the presence of harmful fungi and plant-parasitic nematodes. The assessment identified soil-borne pathogens as constraints on crop productivity and plantation renewal. Pathogen risks also differed among coffee intercropping combinations, showing that diversification does not automatically remove soil health problems (ACIAR, 2026). These findings establish the resource constraints considered in the next section: seasonal freshwater availability, salinity, and nutrient replenishment in Delta rice systems; and irrigation demand, soil condition, and plant health in Central Highlands coffee systems.

6.3 Regenerative Agriculture Practices and Supporting Evidence

Improved water management, balanced nutrition, organic matter management, and suitable crop diversification provide practical starting points for regenerative agriculture in Viet Nam's selected farming systems. Research in the Mekong Delta and Central Highlands documents benefits from particular practices, while also showing that outcomes depend on field conditions and management. Rice studies demonstrate the need to assess yields, soil carbon, and greenhouse gas emissions together, while coffee research highlights the relationship between irrigation, crop combinations, and farm returns (Arai, 2022; Byraredddy et al., 2020; JIRCAS, 2017; Rigal et al., 2023).

Water Management in Rice

Research in the Mekong Delta provides evidence of both the potential and the limitations of alternate wetting and drying. Arai (2022) evaluated this approach in a triple-cropped rice field in Can Tho over five years and 15 consecutive cropping seasons. Compared with continuous

inundation, alternate wetting and drying reduced annual methane emissions by 51 percent and increased rice yield by 9 percent. The experiment demonstrates that controlled changes in irrigation can improve production while reducing emissions under the conditions studied.

Results from other Vietnamese trials show that yield benefits are not uniform. Johnson et al. (2023) evaluated 20 rice varieties over two consecutive dry seasons in An Giang and recorded an average yield reduction of approximately 7 percent under alternate wetting and drying. Responses differed by variety and season, with the timing of drying events relative to crop development affecting performance. The authors emphasized adaptation to the growing environment and genotype, alongside adequate irrigation control. Together, these findings support testing locally appropriate irrigation schedules and varieties rather than assuming that the same drying regime would produce comparable results across the Delta.

Balanced Nutrition and Integrated Input Management

Viet Nam's "One Must Do, Five Reductions" approach combines good-quality or certified seeds with reductions in seed rates, fertilizer inputs, pesticide use, irrigation water, and post-harvest losses. Tho et al. (2021) analyzed survey data from 380 rice farms across four Mekong Delta provinces using a statistical matching approach. They estimated that adopters had approximately 10 percent lower production costs and 10 percent higher profits than conventional producers, alongside higher paddy selling prices. The study did not identify an increase in rice yield. These findings support the economic value of coordinated input management, although they concern the combined package and do not establish the contribution of each individual practice.

Government policy also supports the expansion of improved rice practices. Approved in November 2023, Viet Nam's program to develop one million hectares of high-quality, low-emission rice in the Mekong Delta by 2030 seeks to expand sustainable cultivation, improve farmer incomes, and reduce greenhouse gas emissions by more than 10 percent compared with conventional practices. Its objectives include reducing post-harvest losses and collecting and processing rice straw for reuse. These are program targets rather than evidence of outcomes already achieved, but they establish a policy framework for wider implementation of coordinated production and residue-management practices (Viet Nam Government News, 2023).

In coffee-based systems, nutrient management also needs to address soil condition. An ACIAR-supported assessment of 375 Central Highlands farms identified highly acidic soils and low organic matter despite substantial nutrient inputs. The assessment proposed integrated soil health management, including correcting acidity, using organic amendments and biochar, and reducing reliance on chemical inputs (ACIAR, 2026). This evidence supports diagnosing soil constraints before adjusting fertilizer use. The practical objective would be to maintain adequate crop nutrition while addressing the conditions that limit nutrient availability and root health.

Residue Management and Soil Organic Matter

Research in the Mekong Delta demonstrates the potential value of composted rice straw. JIRCAS examined repeated compost applications across 31 cropping seasons between 2000 and 2015. Treatments combining rice straw compost with chemical fertilizer at 40 or 60 percent of the

conventional rate increased soil carbon and, during 2011–2015, produced yields 0.87 and 0.91 tons per hectare higher in the dry and wet seasons than conventional fertilizer treatments without compost. The experiment also recorded higher plant-available silicon, which the researchers identified as a possible contributor to improved yields (JIRCAS, 2017).

These findings concern sustained applications of processed compost under the experimental conditions, rather than all methods of returning straw to fields. JIRCAS also noted that adding organic material to paddy soils can increase methane emissions, even when compost is well decomposed. Residue management therefore needs to be evaluated alongside irrigation and fertilizer management. For adoption, the relevant considerations would include the availability and cost of straw collection, composting, transport, and application, as well as measured changes in soil condition, yield, and emissions.

Irrigation Management in Coffee

Byrareddy et al. (2020) analyzed ten cropping years of data from 558 coffee farms across four Central Highlands provinces. Their modelling indicated that annual irrigation could be reduced by approximately 300–590 cubic meters per hectare from existing levels in average-rainfall years while maintaining yields above three tons per hectare. Estimated reductions were smaller in dry years, at approximately 30–240 cubic meters per hectare. These are model-based estimates derived from the farms studied, rather than uniform water-saving targets for the region. The practical implication is that irrigation decisions would need to reflect rainfall, soil moisture, and the crops present, with reductions calibrated to avoid damaging water stress.

Diversification in Coffee-Based Systems

Rigal et al. (2023) investigated mixed cropping through 234 farmer interviews in Dak Lak, Dak Nong, and Gia Lai. They documented combinations of coffee, pepper, and fruit trees, particularly avocado, durian, and macadamia. Diversified coffee systems recorded higher gross margins than coffee monocultures and greater resilience to price fluctuations in the study's analysis. However, the margin calculation deducted fertilizer and pesticide costs while excluding labor costs. The findings therefore provide evidence of economic potential without establishing higher net profitability after all production costs.

Crop selection also affects plant health. ACIAR's 2026 assessment found that coffee–cashew and coffee–durian combinations were associated with a lower likelihood of plant-parasitic nematodes, while coffee–pepper and coffee–avocado systems had higher pathogen counts. These associations do not establish that introducing a particular intercrop would cause the same outcome on another farm. They reinforce the importance of assessing crop combinations alongside soil condition and disease risks. For adoption, diversification would need to account for planting density, irrigation requirements, labor, and access to markets for the additional crops.

The evidence supports combining practices according to the needs of each farming system. In Delta rice, controlled irrigation can be assessed alongside nutrient and residue management, with attention to both production and emissions. In Central Highlands coffee, irrigation efficiency, soil health, and crop diversification require coordinated management. Field performance,

implementation costs, and farmer returns would determine the case for adoption. These requirements provide the basis for the agribusiness implications considered in the next section.

6.4 Implications for U.S. Agribusinesses

Viet Nam's selected rice and coffee systems present potential opportunities for U.S. businesses supplying agricultural inputs, machinery, irrigation technologies, digital services, and laboratory equipment, as well as buyers seeking reliable agricultural supplies. Commercial value would come from improving farm productivity and resource efficiency, managing operating costs, and strengthening supply quality and consistency. The following discussion draws on the evidence reviewed above to connect these objectives with relevant company capabilities, potential customers, and delivery arrangements.

Agricultural Inputs and Agronomic Services

For U.S. input suppliers, the opportunity would be to combine suitable products with advice adapted to local production conditions. In rice, Viet Nam's program to develop one million hectares of high-quality, low-emission production by 2030 provides a policy framework for expanding sustainable cultivation and improving farmer incomes (Viet Nam Government News, 2023). Potential offerings could connect seeds, crop nutrition, and crop protection with field demonstrations and technical support delivered through Vietnamese distributors, cooperatives, and agronomists. Repeat purchases would depend on demonstrated improvements in marketable yield, production costs, or crop reliability.

Corteva maintains a dedicated rice crop-protection portfolio in Viet Nam, including herbicides, insecticides, and fungicides, providing an existing commercial connection to the selected crop system (Corteva Agriscience, n.d.-b). Its relevance to the low-emission rice agenda would be in helping farmers coordinate crop protection with changes in establishment, irrigation, and input use. Research in the Mekong Delta identifies weed pressure as a consideration when introducing intermittent field drying (Johnson et al., 2023). A potential offering could combine locally appropriate rice products with field monitoring, application advice, and demonstrations under the intended water regime. Its contribution to regenerative agriculture would depend on effective crop protection, farmer returns, and measured outcomes under local conditions.

Bayer's ForwardFarming initiative provides a documented example of coordinated delivery within Viet Nam. Its partnership with the National Agricultural Extension Center brings together provincial agricultural service centers, the Mekong Delta Rice Institute, fertilizer and seed companies, and farmers in Can Tho, An Giang, and Kien Giang. Bayer's 2024 account describes demonstrations and training covering optimized seed rates, fertilizer application, water management including alternate wetting and drying, and integrated crop protection, with cluster sowing reducing seed use from 150–180 to 60 kilograms per hectare (Bayer, 2024). These components correspond closely to several elements of the "One Must Do, Five Reductions" approach discussed in the previous section (Tho et al., 2021). The arrangement illustrates a

partnership model in which products are tested within complete farming operations, with local partners contributing technical support and market connections.

Coffee offers related opportunities in planting material and crop-health services. USDA's Foreign Agricultural Service reports that approximately 130,000 hectares of old coffee farms were replanted between 2015 and 2021, supported by efforts to upgrade nurseries and supply improved, drought-resistant varieties (USDA Foreign Agricultural Service, 2024). Suppliers with relevant capabilities could assess partnerships with Vietnamese nurseries and agronomic businesses for diagnostics, planting-material quality, and advice during plantation renewal. Given the soil acidity and low organic matter noted in the previous section (ACIAR, 2026), diagnostics could include soil testing, with advice on correcting acidity and using organic amendments before changing fertilizer rates. Offerings would need to account for establishment costs, the period before renewed plantations generate returns, and compatibility with farmers' existing crop combinations.

Machinery and Water-Management Services

The one-million-hectare rice program includes objectives for reducing post-harvest losses and collecting and processing straw for reuse (Viet Nam Government News, 2023). These objectives suggest potential demand for equipment and services supporting crop establishment, harvesting, drying, and residue handling. The straw-compost evidence discussed in the previous section (JIRCAS, 2017) suggests a further role for composting services. Machinery contractors, cooperatives, mills, and processors could be assessed as customers, allowing investment costs to be spread across multiple farms or larger volumes of agricultural material.

John Deere's regional agricultural machinery portfolio illustrates capabilities that could be assessed against these needs (John Deere, n.d.-a). Suitability would depend on field access, plot size, compatibility with existing machinery, operator skills, and seasonal utilization. Equipment sales could be supported by training, maintenance, and parts supply, while contractors would need sufficient bookings and reliable performance to recover their investment. Demonstrations would help establish whether particular machines or attachments improve operational efficiency at a service price farmers can afford.

Coffee presents a distinct opportunity for irrigation design, installation, scheduling, and maintenance. USDA Foreign Agricultural Service (2024) reports that irrigation systems remain expensive for coffee farmers and are used on only about 5 percent of coffee farms, and that falling groundwater levels make irrigation more difficult in some production areas. The irrigation savings estimated by Byraredy et al. (2020) suggest value in scheduling services that match water application to rainfall and soil moisture. Potential offerings could combine suitable equipment with technical support and financing arrangements that spread initial expenditure over time. Farmers would need benefits such as lower pumping costs, reduced labour requirements, or more reliable water application. Service providers would need an adequate customer base to support installation and maintenance beyond the initial sale.

Digital Services, Traceability, and Emissions Measurement

Viet Nam already has digital infrastructure for recording rice production and farm practices. IRRI's RiceMoRe supports production reporting and geographic mapping, while its linked FarMoRe application records farm activities and supports performance assessment, advisory services, and traceability. Both were transferred to Viet Nam's Ministry of Agriculture and Rural Development in September 2024, and RiceMoRe had expanded to 29 provinces covering about 75 percent of the country's rice area by the end of that year (IRRI, n.d.-a, n.d.-c). These systems provide an operating context for U.S. providers of sensors, remote sensing, farm software, and data services.

Potential customers include cooperatives, processors, exporters, and program implementers requiring reliable information across multiple farms. Commercial offerings could improve field data collection, connect equipment records with production records, or help buyers assess compliance with purchasing requirements. Their value would need to come from practical benefits such as simpler recordkeeping, more timely advice, or lower verification costs. Compatibility with existing systems, Vietnamese-language support, and clear arrangements for data access would be important to service delivery.

The low-emission rice agenda also creates potential demand for measurement, reporting, and verification services. IRRI's work with Vietnamese agencies identifies technical needs for emissions accounting at project, sector, and national levels (IRRI, 2023). U.S. firms could assess services that document cultivation practices, manage supporting evidence, and estimate emissions using accepted methods. A viable arrangement would require an identified customer and clear responsibility for monitoring and verification costs. Potential carbon revenue would need separate assessment rather than being assumed from participation in improved farming practices.

Sourcing Partnerships and Supply Reliability

For U.S. buyers and processors, the business case would centre on consistent quality, dependable deliveries, and procurement costs. The Sustainable Mekong Rice initiative illustrates how technical support can be connected to commercial purchasing. Its collaboration among SunRice, Vietnamese universities, and farmers includes production planning, traceability, compliance with pesticide-residue limits, and direct delivery of paddy to mills. The initiative engaged more than 354 market actors, and participating farmers received premiums of over VND 300 per kilogram (about USD 12 per tonne) for residue-compliant rice (ACIAR, 2025). The arrangement provides a relevant model for U.S. buyers considering similar relationships.

Coca-Cola provides a commercial connection to Vietnamese coffee through Costa, whose current product information identifies Viet Nam among the origins of its Mocha Italia Dark Roast (Costa Coffee, n.d.). The Coca-Cola Company's 2025 annual report describes Costa's purchases of certified green coffee through multiple suppliers, linking supplier diversification to managing weather-related production risks (The Coca-Cola Company, 2026). These sourcing interests suggest potential opportunities to work with Vietnamese exporters and producer groups on quality assurance, traceability, and technical assistance that supports reliable production. In mixed coffee systems, such assistance would need to accommodate farmers' labour schedules and management decisions across coffee, pepper, and fruit (Rigal et al., 2023). The commercial objective would be

to strengthen supply consistency while providing farmers with purchasing terms and returns that justify participation.

PepsiCo offers a complementary example from Viet Nam's potato sector, outside the chapter's selected rice and coffee systems. The Ministry of Agriculture and Environment describes a sustainable potato partnership involving PepsiCo Foods Viet Nam, the National Agricultural Extension Center, and Syngenta, linking production improvements with domestic supply development in a market where local production meets only 30–40 percent of demand (Ministry of Agriculture and Environment, 2025). PepsiCo also identifies Vietnamese potatoes within its global regenerative agriculture efforts (PepsiCo, 2025b). Its relevance here is the commercial model: a processor can connect technical support and improved farm management with demand for a specific agricultural ingredient. Similar arrangements in rice or coffee would require their own crop-specific evidence, purchasing commitments, and farmer incentives.

Cargill adds a potential connection between rice processing and feed markets. Its Vietnamese operations include animal nutrition, commodity trading, and supply-chain management, while its global aquaculture business documents the use of rice bran and other processing co-products as feed ingredients (Cargill, n.d.-b, n.d.-c). These capabilities suggest scope to assess commercial arrangements between Vietnamese rice mills and feed manufacturers for suitable milling by-products. Viability would depend on consistent quality, safe storage, transport costs, and feed-formulation requirements. This represents a potential route to improve resource use and generate additional value from rice processing; it would complement farm-level improvements but would not itself demonstrate regenerative cultivation.

Laboratory testing could support these sourcing relationships by helping suppliers demonstrate that products meet purchasing specifications. Thermo Fisher Scientific has published methods for pesticide-residue testing in rice and presents contaminant analysis in coffee among its food-testing applications, providing capabilities relevant to both selected crops (Azad & Oulkar, 2019; Thermo Fisher Scientific, n.d.). Potential customers would include Vietnamese commercial laboratories and testing facilities operated by processors or exporters. Offerings could combine analytical instruments, consumables, methods, training, and maintenance, with commercial value arising from reliable results and timely purchasing decisions. Testing would complement traceability and farm records, while evidence of regenerative performance would require assessment of cultivation practices and environmental outcomes.

Across these arrangements, buyers would need improvements in quality consistency, delivery reliability, or procurement efficiency that justify their contribution. Farmers would need clear specifications, transparent purchasing terms, and sufficient returns to cover additional requirements. Where purchasing agreements also require evidence of environmental performance, monitoring and verification costs would need to be allocated explicitly between participating parties.

Commercial Priorities and Conditions for Expansion

Initial priorities would differ between the selected systems. In Mekong Delta rice, potential offerings could focus on coordinated inputs and advice, contractor operations, residue and by-

product handling, and production monitoring linked to mills and buyers (IRRI, n.d.-a, n.d.-c; Viet Nam Government News, 2023). In Central Highlands coffee, irrigation services, plantation renewal, diagnostics, and sourcing support suited to mixed cropping provide more relevant starting points (Rigal et al., 2023; USDA Foreign Agricultural Service, 2024). Laboratory testing could support quality assurance across both supply chains.

For expansion, the commercial assessment would need to establish who pays, when benefits materialize, and whether revenues cover continued delivery. Equipment costs already constrain adoption of improved coffee irrigation (USDA Foreign Agricultural Service, 2024), suggesting that payment schedules would need to reflect customers' seasonal cash flow and investment recovery periods. Repeat purchases, service renewals, and continued farmer participation would provide practical indicators of whether an offering can sustain demand beyond initial demonstrations or introductory support.

7. Cross-country Comparison and Recommendations

The three country assessments identify distinct opportunities for regenerative agriculture and related agribusiness services. Differences in water control, soil conditions, crop combinations, and commercial relationships shape which interventions are relevant and how they could be delivered. Table 2 brings together the principal findings for the selected farming systems and draws out their implications for U.S. firms.

7.1 Priorities Across the Selected Farming Systems

Table 2

Farm Management Priorities and Commercial Starting Points by Country

Country and Selected Systems	Priorities for Farm Management	Potential Commercial Starting Points
Myanmar: Delta rice; Central Dry Zone pulses and oilseeds	Seasonal water management and suitable rice–pulse sequences; coordinated moisture conservation, residue retention, diversification, and nutrition in the Dry Zone.	Locally tested inputs with soil testing and agronomic advice; contractor planting services suited to retained residues; water-level and salinity monitoring.
Thailand: Central Plains rice; Northeastern rice; northern potato	Controlled irrigation in suitable rice fields; nutrient management matched to moisture availability; appropriate straw handling; coordinated drainage and field preparation across potato rotations.	Machinery and irrigation services; straw collection and processing; field-specific input advice; planting-material and crop-health support linked to potato processors; rice monitoring and verification services.
Viet Nam: Mekong Delta rice; Central Highlands coffee	Coordinated rice irrigation, input, and residue management; coffee irrigation scheduling, soil improvement, and suitable crop combinations.	Rice production services linked to cooperatives and mills; straw collection and composting; coffee irrigation, soil diagnostics, and plantation-renewal support; traceability and sourcing partnerships.

Source: Author's synthesis of the country assessments and sources cited therein.

Water management provides a common opportunity across the three countries, but customer needs differ. In Myanmar's coastal Delta, salinity can make water-quality information a necessary first step before changing irrigation practices. In Thailand, the distinction between irrigated and rainfed rice separates opportunities for controlled irrigation from advice focused on moisture availability and attainable yields. In Viet Nam's Mekong Delta, responses to alternate wetting and drying vary with rice variety and season, while in the Central Highlands the evidence points to improving irrigation scheduling within established coffee systems. These differences favour offerings

organized around specific water-management problems, with equipment and advice selected accordingly (Byrareddy et al., 2020; Haefele & Konboon, 2009; Johnson et al., 2023; Prangbang et al., 2020; Sakai et al., 2021).

Soil management creates a similar need for differentiated services. Myanmar's Dry Zone combines inadequate nutrient supply with competing livestock uses of crop residues. Northeastern Thai rice requires fertilizer decisions that reflect field position and seasonal moisture. Vietnamese coffee systems face soil acidity and low organic matter despite substantial nutrient inputs. Together, these findings suggest a role for diagnostics and agronomic advice that determine whether the priority is additional nutrition, more effective application, correction of soil constraints, or improved organic matter management (ACIAR, 2026; Haefele & Konboon, 2009; Herridge et al., 2019).

The scale and timing of investment also differ across systems. Seasonal input and contractor services can be assessed over individual cropping cycles, while coffee irrigation and plantation renewal require longer-term investment. Irrigation systems remain expensive for coffee farmers and are used on only about 5 percent of coffee farms (USDA Foreign Agricultural Service, 2024). Likewise, irrigation investments have limited value where freshwater supply or drainage remains inadequate (Prangbang et al., 2020; Sakai et al., 2021). These distinctions affect which customers can use an offering and how expenditure would be recovered.

7.2 Recommendations for U.S. Agribusinesses

Match commercial entry points to existing delivery arrangements. In Myanmar, the evidence supports assessing focused offerings through local input businesses and machinery contractors, with particular attention to purchasing power and the ability to deliver and service products in target locations. Reported credit and security constraints make these considerations central to the scale of initial engagement (Belton et al., 2021; Hnin Ei Win & Minten, 2026; Myanma Awba Group, n.d.-a). In Thailand, agricultural service initiatives and processor relationships offer routes for machinery, irrigation, and potato-production support (IRRI, n.d.-b; PepsiCo, 2025a; Pongputhinan, 2024), with farm financing available through the Thai Rice GCF project (Rice News Today, 2026). In Viet Nam, cooperatives, mills, exporters, and extension partnerships provide potential channels for coordinating rice inputs, field operations, and purchasing requirements (ACIAR, 2025; Bayer, 2024).

Develop services around connected farm operations. The country findings suggest value in combining complementary capabilities. In the Dry Zone, planting through retained residues would need to work alongside weed control and adequate nutrition. In northern Thailand, land preparation and drainage services would need to accommodate the transition between rice and potatoes. In Vietnamese coffee, irrigation and plantation-renewal support could incorporate soil diagnostics and advice suited to existing intercrops. For suppliers, these relationships identify practical areas for collaboration with agronomists, contractors, nurseries, and local distributors (ACIAR, 2026; Herridge et al., 2019; Pongputhinan, 2024; Rigal et al., 2023).

Connect digital services to identified operational or purchasing needs. Thailand's developing rice-emissions monitoring system and Viet Nam's RiceMoRe and FarMoRe platforms provide an existing context for data services. Potential offerings could help cooperatives, processors, and

program implementers collect field records, connect information across farms, or document production requirements. Compatibility with these systems would be an important consideration. In Myanmar's selected systems, the evidence reviewed points more directly to targeted water-level and salinity information as an initial service opportunity (IRRI, n.d.-a, n.d.-c, 2025; Sakai et al., 2021).

Use sourcing relationships to support changes that matter to buyers and farmers. Thailand's potato and rice sourcing partnerships and Viet Nam's buyer-linked rice initiatives illustrate how technical assistance can be connected to ingredient supply and quality requirements. These arrangements provide a basis for assessing whether buyers could contribute to agronomic support, testing, or traceability where the benefits improve procurement. In Myanmar, comparable arrangements for the selected crops remain prospective within the evidence reviewed and would first require an identified buyer and suitable local aggregation channels (ACIAR, 2025; Mars, 2025; The Nation Thailand, 2025; PepsiCo, 2025a).

Across these opportunities, this report supports expansion from clearly defined farming systems and commercial relationships. Evidence from the country chapters can guide the choice of initial offerings, while local results would determine how far those offerings can be extended to other production areas.

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