Agronomy Solution Profile for Mechanized direct seeded rice (mDSR)

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AUTHORSHIP:
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Executive Summary

Mechanized direct seeded rice (mDSR) is a rice cultivation method involving sowing rice seeds directly into the field using specialized machinery. This eliminates the need for traditional transplanting of rice seedlings from a nursery. The equipment used in mDSR prepares the seedbed, precisely places seeds, and applies necessary inputs like fertilizers, all in a single operation. This integrated approach significantly reduces manual labor and time associated with establishing a rice crop.

mDSR offers several advantages over traditional transplanting, including reduced water consumption (12-35%, up to 30%), significant reduction in labor requirements and associated costs (up to 40%), lower greenhouse gas emissions (10-90%, 18-20% methane reduction), and faster crop establishment. It also leads to increased profitability for farmers through reduced input costs, faster crop establishment, and enhanced yields. In Vietnam, farmers adopting mDSR experienced a 50% reduction in seed usage, a 20% reduction in fertilizer usage, a 5% increase in yields, a US$200 increase in profit per hectare, and a 10% reduction in carbon footprint. In Cambodia, potential yield increases of up to 0.9 tons per hectare and 40% higher profits have been projected.

IRRI has actively invested in the research and development of mDSR. Engagement with individual influencers, such as farmers Vo Van Than and In Soun, who successfully adopted mDSR, has been positive. mDSR has been integrated into existing agricultural practices and government programs, demonstrating fit into delivery, business, social, and cultural systems, including adaptation to different farming systems in Cambodia and Vietnam.

mDSR demonstrates superior performance compared to alternatives like manual transplanting and broadcasting. It is more cost-effective due to reductions in labor, water, seed, and fertilizer inputs. Farmers using mDSR report easier operation due to the elimination of transplanting seedlings. Ongoing efforts focus on providing farmers with technical knowledge and skills to further improve effectiveness.

Adoption of mDSR is increasing, especially in the Mekong River Delta and Northwest Cambodia. The majority of users are smallholder farmers seeking enhanced productivity and sustainability. While farmers are transitioning towards mDSR, challenges remain regarding dependence on external support for technical knowledge and inputs for issues like weed and pest pressure.

Several milestones in the development and adoption of mDSR remain unspecified in the document, including the exact dates of IRRI's involvement in research and development, collaborations with local partners, knowledge dissemination efforts, policy advocacy, initial adoption in Northwest Cambodia, specific dates for the One-Million-Ha program and its impact, and dates for mARD endorsement and national guidelines in Vietnam. This information could be collected through further research and documentation efforts, including interviews with IRRI staff, government officials, and farmers, along with a review of official documents and reports.

Solution Description

Mechanized direct seeded rice (mDSR) is a rice cultivation method that involves sowing rice seeds directly into the field using specialized machinery. This eliminates the need for traditional transplanting of rice seedlings from a nursery, thus streamlining the planting process. The

equipment used in mDSR is designed to prepare the seedbed, precisely place seeds, and apply necessary inputs like fertilizers, all in a single operation. This integrated approach significantly reduces manual labor and time associated with establishing a rice crop.
The key superior characteristic of mDSR lies in its efficiency and resource optimization. By direct seeding, it drastically reduces water consumption, as there is no need for flooded nurseries and transplanting which are typical to traditional rice farming. mDSR also lowers labor requirements, using machinery for tasks that are traditionally done by hand. This method leads to faster crop establishment, as seedlings do not experience transplanting shock, accelerating growth and reducing the vulnerability of plants to initial stresses. The use of machines ensures precise seed placement, contributing to more uniform crop stands.
A critical function of mDSR is the integration of mechanization into the direct seeding process. The machinery enables uniform seed distribution, optimized planting depth, and precise fertilizer placement, which are difficult to achieve with manual methods. This automation also increases the efficiency of each task, allowing for large-scale sowing in a much shorter timeframe than traditional methods. It supports faster cultivation cycle and reduces the risk of crop loss due to delayed or inconsistent planting as the sowing process is more reliable and consistent with mechanized approach.

Value Statement

Mechanized Direct Seeded Rice (mDSR) offers a transformative approach to rice cultivation, delivering significant economic and environmental value. By dramatically reducing input costs such as labor, water, and seeds, mDSR increases profitability for farmers. Its efficiency also leads to faster crop establishment and enhanced yields, further boosting returns. mDSR contributes to sustainable agriculture by significantly reducing greenhouse gas emissions and water consumption. Therefore, mDSR is an investment that drives both economic progress and environmental stewardship.

Pitch

We are at the cusp of a revolution in rice farming, and Mechanized Direct Seeded Rice (mDSR) is the key. mDSR is not just a farming technique; it is a pathway to greater yields, reduced costs, and a smaller environmental footprint. Our research in Cambodia and Vietnam demonstrates that mDSR is not only viable but superior, offering farmers a chance to increase their incomes and make a positive impact on the planet. We are calling on visionary investors to join us in scaling mDSR globally. By investing in this technology, you are not only supporting the future of food security, you are investing in a sustainable and profitable future for all involved. Invest in mDSR, and let's grow a more resilient and prosperous world together.

Component Analysis

Table 1.a Key Components of Mechanized Direct Seeded Rice (mDSR)

Component Name	Description	Component Type
Rice Seeder Machine	A machine used for sowing rice seeds directly into the field, eliminating the need for transplanting. This machine can plant rice in uniform rows, reducing seed, fertilizer, and	Machinery

Component Name	Description	Component Type
	pesticide use, and labor time.	
Seed Metering Mechanism	This part of the seeder divides the seeds for controlled sowing and is prone to break off. A good system should allow for a reduction in seed usage.	Machinery Part

Maintenance of agricultural equipment

Table 1.b Key Components of Mechanized Direct Seeded Rice (mDSR) under Maintenance of agricultural equipment

Cleaning	Machinery and equipment should be cleaned before and after use to minimize the spread of weeds and pests.	Process
Regular checks	Regular inspection, repair, and maintenance of machinery and equipment before and after use are needed.	Process
Lubrication	Applying oil or grease to critical parts of machinery and equipment before and after use helps ensure smooth operation.	Process
Storage	Machinery and equipment should be stored in a safe place, avoiding exposure to rain and sun, as some parts are made of plastic or metal that can easily corrode or break.	Process

Alternative Solutions

Table 2. Alternative Solutions to Mechanized direct seeded rice (mDSR)

Alternative solution name	**URL of website providing information**	**Type of the solution**	**Geographies it is available**	**Key features of the solution**	**Advantages of the alternative compared to Mechanized direct seeded rice (mDSR)**	**Disadvantages of the alternative compared to Mechanized direct seeded rice (mDSR)**
Manual	insufficient	Traditional	Cambodia,	Transplantin	Lower initial	Higher labor

Alternative solution name	URL of website providing information	Type of the solution	Geographies it is available	Key features of the solution	Advantages of the alternative compared to Mechanized direct seeded rice (mDSR)	Disadvantages of the alternative compared to Mechanized direct seeded rice (mDSR)
Transplanting	evidence	agricultural practice	Vietnam and other rice-growing regions	g rice seedlings grown in nurseries into flooded fields by hand.	investment costs as it does not require specialized machinery. Suitable for very small landholders who cannot afford to buy mechanized tools.	costs, slower crop establishment, higher water consumption, increased greenhouse gas emissions, more vulnerability to transplant shock, increased potential for root damage, and higher chance of lodging.
Manual Direct Seeding (Broadcast)	insufficient evidence	Traditional agricultural practice	Cambodia, Vietnam and other rice-growing regions	Broadcasting rice seeds by hand into prepared fields	Lower initial investment cost. Slightly lower labor requirement compared to manual transplanting.	Higher seed rates, less uniform crop establishment, increased weed and pest pressure, leading to lower yields and profits compared to mDSR. More prone to seed losses to birds. Can increase the usage of pesticides.
Dry Direct Seeded Rice (DDSR)	https://excellenceinbreeding.org/news/i	Agricultural practice variation	Cambodia, Vietnam	Sowing seeds directly into	Eliminates the need for nurseries	Higher risk of weed infestation,

Alternative solution name	URL of website providing information	Type of the solution	Geographies it is available	Key features of the solution	Advantages of the alternative compared to Mechanized direct seeded rice (mDSR)	Disadvantages of the alternative compared to Mechanized direct seeded rice (mDSR)
without mechanization	rri-overcomes-barriers-and-bottlenecks-towards-rice-breeding-revolution			dry soil without machinery	and transplanting, reduces labor costs compared to transplanting, can be practiced by any farmers and reduces the initial investment costs by not using machinery	pest and disease susceptibility, requires intensive weed management, and can lead to lower yields than mDSR if not managed well.
Alternate Wetting and Drying (AWD) with traditional transplanting	https://ricenewstoday.com/irri-vietnam-launches-model-rice-fields-to-promote-sustainable-agriculture/	Water management strategy	Vietnam (implemented under the "One-Million-Ha" program)	Controlled irrigation where fields are alternately flooded and dried. Can be applied together with traditional transplanting	Reduces water consumption and methane emissions compared to continuously flooded rice cultivation. Applicable to the traditional transplanting method.	Does not address labor shortages, slower crop establishment compared to mDSR, may not be as effective in reducing greenhouse gas emissions as mDSR, does not reduce pest problems and it increases cost of labor.

User Profile

Co-developers of Mechanized Direct Seeded Rice (mDSR) in

Cambodia and Vietnam

The International Rice Research Institute (IRRI) is a central co-developer of mDSR technology in Cambodia and Vietnam. They have conducted extensive research on suitable rice varieties, weed and pest management, and machinery development. IRRI has collaborated with local partners including government agencies like the Vietnamese Ministry of Agriculture and Rural Development (MARD), research institutions, and private sector partners in both Cambodia and Vietnam to develop and promote the technology. Specifically, IRRI's work with MARD on the "One Must Do, Five Reductions" program in Vietnam highlights a key co-development partnership. IRRI's Excellence in Agronomy Initiative (EiA), in collaboration with MARD, is also pivotal in promoting mDSR in Vietnam.

Users of Mechanized Direct Seeded Rice (mDSR) in Cambodia and Vietnam

Farmers:

The primary users are rice farmers in both Cambodia and Vietnam, adopting mDSR as an alternative to traditional transplanting methods. In Cambodia, particularly in Northwest Cambodia, many farmers have transitioned to broadcast direct seeding due to labor shortages, though some may be using this method without mechanization. mDSR is gaining traction, especially with farmers seeing demonstrations and training by organizations like IRRI. In Vietnam, adoption is notable in the Mekong River Delta, where a significant portion of farmers have moved to mDSR. The One-Million-Ha program in Vietnam is also pushing for wide adoption of mDSR and related practices.

Agricultural Extension Services and Local Partners:

These entities assist in promoting and facilitating adoption of mDSR, providing training, demonstrations, and local support to farmers.

Beneficiaries of Mechanized Direct Seeded Rice (mDSR) in Cambodia and Vietnam

Farmers:

Farmers are the primary beneficiaries, experiencing increased incomes, reduced production costs (less labor, water, seeds, fertilizers), and improved yields. Specific case studies cited show examples such as a 50% reduction in seed usage, a 7% increase in grain yield, and a 17% increase in profits for a farmer in Vietnam, while another saw a 40% increase in profits in Cambodia. Additionally, reduced labor needs are particularly beneficial to farmers, in light of labor shortages from rural out-migration.

National and Local Economies:

The increased productivity and efficiency of rice farming contribute to economic development. Higher yields and lower production costs for farmers translate to increased market supply and greater profitability for the sector.

Environment:

Reduced water consumption and decreased greenhouse gas emissions benefit the environment. This leads to more sustainable agricultural practices.

Sponsors of Mechanized Direct Seeded Rice (mDSR) in Cambodia and Vietnam

While specific sponsors are not named in the provided documents, it is likely that multiple sources contribute to the promotion of mDSR. IRRI appears to be a key sponsor by directly investing in research, development, and knowledge dissemination. Government agencies in Cambodia and Vietnam, such as MARD, are also indirectly sponsors through their support and partnership with IRRI, as well as through programs like the One-Million-Ha program.
International funding agencies and development organizations that support agricultural and sustainability programs, would be possible sponsors.
Additionally, the private sector can be considered as sponsors through their engagement in manufacturing and selling of the machinery related to mDSR.

Table 3. User Facts on Mechanized direct seeded rice (mDSR)

Category	Description	Quantitative Facts (from the provided text)
Co-developers	Organizations involved in the design, testing, and promotion of mDSR	● International Rice Research Institute (IRRI) ● Vietnamese Ministry of Agriculture and Rural Development (MARD) ● Research institutions in Cambodia and Vietnam ● Private sector partners
Users	Individuals and organizations using mDSR in their agricultural practices	● Rice farmers in Cambodia (particularly Northwest Cambodia) ● Rice farmers in Vietnam (particularly in the Mekong River Delta) ● Agricultural extension services in Cambodia and Vietnam ● Local partners facilitating adoption of mDSR
Beneficiaries	Individuals and organizations who experience positive outcomes from the use of mDSR	● Farmers: Increased income, reduced production costs (40% labor cost reduction, seed reduction of 50% in some cases, up to 35% less water, 20% reduction in fertilizer usage), increased profits (7% to 17% increase in

		some examples, up to 40% higher in one case study, US$200/ha in another), and higher yields (7% to 5% increase in some examples, up to 0.9 tons/ha higher in a Cambodian study, approximately 20% on another source, however those should be validated further). ● National and local economies: Increased productivity and efficiency in the rice sector. ● Environment: Reduced water consumption (12-35% reduction), lower greenhouse gas emissions (10-90% reduction, or 18-20% reduction in methane, also mentioned as 10% reduction in carbon footprint) and improved soil health.
Sponsors	Organizations and entities providing funding, resources, and support for the development and adoption of mDSR	● International Rice Research Institute (IRRI) (funding research, knowledge dissemination, and technology development) ● Government agencies, such as the Vietnamese MARD, Cambodian General Directorate of Agriculture (through collaborations, policy support) ● International funding agencies and development organizations (estimated) ● Private sector companies producing agriculture equipment (estimated)

Timeline

Table 4. Evolution timeline of Mechanized direct seeded rice (mDSR)

Date	Milestone	Brief Explanation
Unspecified	Introduction of Direct Seeded Rice (DSR)	DSR, eliminating transplanting, starts to be seen as a climate-resilient technology addressing labor shortages and the need for increased productivity in Southeast Asia.
Unspecified	Development of Mechanized DSR (mDSR)	Machinery is introduced for seeding and other field operations, further enhancing efficiency and reducing labor needs in DSR.
Unspecified	IRRI's involvement in mDSR research and development	IRRI begins research on suitable rice varieties, weed and pest management, and appropriate machinery for mDSR in Cambodia and Vietnam. Focus is placed on dry direct seeded rice (DDSR).
Unspecified	IRRI collaborates with local partners	IRRI works with government agencies, research institutions, and private sector partners in Cambodia and Vietnam to promote mDSR and provide training to farmers.
Unspecified	IRRI's knowledge dissemination	IRRI publishes research papers, reports, and training materials on mDSR.
Unspecified	Field trials and demonstrations	IRRI conducts field trials and demonstrations of mDSR in Cambodia and Vietnam.
Unspecified	IRRI advocates for policy support	IRRI engages with policymakers to support mDSR and sustainable rice production.
Unspecified	Initial mDSR adoption in Northwest Cambodia	Due to labor shortages, most rice farmers in Northwest Cambodia shift from manual transplanting to broadcast direct seeding, initially leading to new challenges like high seed rates and weed pressure.
Unspecified	IRRI promotes mDSR in Cambodia	IRRI actively promotes mDSR as a solution to the challenges

Date	Milestone	Brief Explanation
		of direct seeding in Cambodia, showcasing potential for higher yields and profits.
Unspecified	mDSR adoption in Vietnam, particularly Mekong River Delta	Vietnam sees significant progress in mDSR adoption, especially in the Mekong River Delta region.
Unspecified	Excellence in Agronomy Initiative (EiA)	Collaboration between IRRI and the Vietnamese Ministry of Agriculture and Rural Development (MARD) promotes mDSR in Vietnam with a focus on increasing yields, profits and reducing environmental footprint.
Unspecified	Vietnam's One-Million-Ha program	Vietnam implements the "One-Million-Ha" program mandating mDSR and fertilizer placement, aiming to increase yields and reduce environmental impact.
Unspecified	Significant reduction in seed, fertilizer usage, increased yields and profits, reduced carbon footprint in Vietnam.	EiA initiatives result in 50% reduction in seed usage, 20% reduction in fertilizer usage, 5% increase in yields, US$200 increase in profit per hectare, and 10% reduction in carbon footprint for participating farmers.
2023	mDSR endorsement and national guidelines in Vietnam.	MARD officially endorses mDSR and issues national guidelines for its implementation in the Mekong River Delta.
Unspecified	mDSR reduces water consumption	mDSR contributes to water conservation in regions facing water scarcity.
Unspecified	mDSR contributes to lower greenhouse gas emissions	By reducing methane emissions, mDSR helps mitigate climate change.
Unspecified	mDSR improves soil health	mDSR improves soil physical properties compared to puddled transplanting.
Unspecified	mDSR increases farm income	mDSR increases farmers' income by reducing input costs and increasing yields.
Unspecified	mDSR reduces production costs	mDSR lowers production costs by reducing labor, water, and other input requirements.

Date	Milestone	Brief Explanation
Unspecified	mDSR enhances economic benefits	mDSR contributes to improved economic benefits for farmers and the agricultural sector.
Unspecified	Adoption of mDSR aligns with broader goals of sustainable development and climate change mitigation	Reduced water consumption and greenhouse gas emissions with enhanced economic well-being of farmers.

Contributed Results

Table 5. Results Achieved By Mechanized direct seeded rice (mDSR)

Impact	Scope of the Impact	Quantity
Reduced Water Consumption	Cambodia and Vietnam	12-35% reduction
Reduced Water Consumption	Cambodia and Vietnam	Up to 30% reduction
Reduced Labor Requirements	Cambodia and Vietnam	Significant reduction
Reduced Labor Costs	Cambodia and Vietnam	40% reduction
Reduced Greenhouse Gas Emissions	Cambodia and Vietnam	10-90% reduction
Reduced Greenhouse Gas Emissions (Methane)	Cambodia and Vietnam	18-20% reduction
Faster Crop Establishment	Cambodia and Vietnam	Faster
Increased Profitability	Cambodia and Vietnam	Increased
Reduced Seed Usage (Vietnam)	Mekong River Delta, Vietnam	50% reduction
Increased Grain Yield (Vietnam)	Mekong River Delta, Vietnam	7% increase
Increased Profits (Vietnam)	Mekong River Delta, Vietnam	17% increase
Higher Yields (Potential in Cambodia)	Cambodia	Up to 0.9 tons/ha increase
Higher Profits (Potential in Cambodia)	Cambodia	40% increase
Reduced Seed Usage (Vietnam EiA Initiative)	Vietnam	50% reduction
Reduced Fertilizer Usage (Vietnam EiA Initiative)	Vietnam	20% reduction
Increased Yields (Vietnam EiA Initiative)	Vietnam	5% increase
Increased Profit Per Hectare (Vietnam EiA Initiative)	Vietnam	US$200 increase
Reduced Carbon Footprint (Vietnam EiA Initiative)	Vietnam	10% reduction

Impact	Scope of the Impact	Quantity
Reduced seed, fertilizer, and pesticide use, labor time	Battambang, Cambodia (using Eli Rice Seeder)	Reduced
Reduced risk of lodging	Cambodia and Vietnam	Reduced
Improved soil physical properties	Cambodia and Vietnam	Improved
Reduced production costs	Cambodia and Vietnam	Reduced

Table 6. Mechanized direct seeded rice (mDSR) Facts Mapped to Donor and Investor Organizations

Impact	Key Donor and Investor Organization
Reduced Water Consumption (12-35%)	World Bank (supporting projects with water-saving technologies)
Reduced Water Consumption (Up to 30%)	Asian Development Bank (focus on water resource management in agriculture)
Reduced Labor Requirements (Significant reduction)	International Labour Organization (promoting decent work and labor-saving technologies)
Reduced Labor Costs (40%)	Private sector agricultural technology companies (investing in mechanized solutions)
Reduced Greenhouse Gas Emissions (10-90%)	Food and Agriculture Organization of the United Nations (promoting climate-smart agriculture)
Reduced Greenhouse Gas Emissions (Methane) (18-20%)	Global Environment Facility (funding climate change mitigation projects)
Faster Crop Establishment (Faster)	National research institutions (conducting research on efficient crop establishment methods)
Increased Profitability (Increased)	Bill & Melinda Gates Foundation (focusing on agricultural productivity and income improvement)
Reduced Seed Usage in Vietnam (50%)	USAID (supporting agricultural development programs in Southeast Asia)
Increased Grain Yield in Vietnam (7% increase)	CGIAR centers (conducting research on yield improvement)
Increased Profits in Vietnam (17% increase)	Private investors in agriculture (looking for return on investment in sustainable farming practices)
Higher Yields (Potential in Cambodia) (Up to 0.9 tons/ha increase)	World Food Programme (supporting food security and improved agricultural practices)
Higher Profits (Potential in Cambodia) (40% increase)	IFAD (investing in rural poverty reduction through agricultural development)
Reduced Seed Usage in Vietnam (50%)	Government of Vietnam (implementing the "One-Million-Ha program")
Reduced Fertilizer Usage in Vietnam (20%)	International Fertilizer Development Center (IFDC) (focusing on sustainable fertilizer practices)
Increased Yields in Vietnam (5% increase)	National governments in Southeast Asia (promoting policies to improve agriculture and food security)

Impact	Key Donor and Investor Organization
Increased Profit Per Hectare in Vietnam (US$200 increase)	Private sector input companies (promoting cost-effective solutions for farmers)
Reduced Carbon Footprint in Vietnam (10% reduction)	Climate Change focused investors (investing in practices that reduce carbon emissions)
Reduced seed, fertilizer, and pesticide use, labor time (Reduced)	Local NGOs (working to improve farming practices in Cambodia)
Reduced risk of lodging (Reduced)	Agricultural insurance providers (interested in reducing the risk of crop loss)
Improved soil physical properties (Improved)	Soil Science focused research organizations (researching the benefits of different farming practices)
Reduced production costs (Reduced)	Microfinance institutions (supporting farmers' access to affordable credit to adopt new technologies)

Geographical Scope

Table 7. Locations Mechanized direct seeded rice (mDSR) Was Designed, Developed, Tested and Implemented/Used

Stage	Geography	Period
Developed	Cambodia and Vietnam	Unspecified
Tested	Cambodia (Battambang, Northwest Cambodia) and Vietnam (Mekong River Delta)	Unspecified
Used	Cambodia (Battambang, Northwest Cambodia) and Vietnam (Mekong River Delta)	Unspecified
Scaled	Unspecified	Unspecified

Readiness Dashboard

Table 8. Readiness Dashboard of Mechanized direct seeded rice (mDSR)

	Previous Successful Activities	Current Activities	Key Performance Quantities
Funding/investment in it	IRRI has actively worked in research and development of mDSR.	Continued research and development by IRRI, along with collaborations between governments and other organizations.	Sufficient evidence is not available
Engagement with most influential specific individual	Farmers like Vo Van Than and In Soun successfully adopted mDSR. Ms. Nhu He did an economic analysis that showed substantial	Ongoing farmer adoption and success stories. Dissemination of information and training.	Farmer adoption leading to increased yields and profits.

	Previous Successful Activities	Current Activities	Key Performance Quantities
influencers (not groups) in the relevant sectors	savings due to mDSR.		
Fit into existing delivery, business, social, cultural systems	mDSR was promoted by IRRI through collaboration with local partners, government agencies, research institutions, and the private sector.	Integration of mDSR into existing agricultural practices and government programs.	Adaptation of mDSR to different farming systems in Cambodia and Vietnam.
How it performs compared to alternatives	mDSR offers benefits compared to traditional transplanting, including reduced water and labor, lower emissions and faster establishment.	mDSR is continuously being compared against traditional transplanting methods in the areas of efficiency, cost and environmental impact.	12-35% reduction in water consumption, significant reduction in labor, 10-90% reduction in greenhouse gas emissions, increased profitability and faster crop establishment are achieved by mDSR.
How cost-effective compared to alternatives	mDSR was shown to reduce seed usage, water, and fertilizer.	Ongoing reduction of input costs and increased profitability for farmers using mDSR are happening.	40% reduction in labor costs. Farmers experienced a 50% reduction in seed usage, 20% reduction in fertilizer usage, and a US$200 increase in profit per hectare.
How effortless, easy to use compared to alternatives	mDSR is easier to use because it eliminates the need for transplanting seedlings.	Ongoing efforts to provide farmers with the technical knowledge and skills to effectively use mDSR are being made.	Sufficient evidence is not available.
The number of users	Adoption in Mekong River Delta and Battambang.	Increasing adoption, especially in Mekong River Delta and Northwest Cambodia.	Insufficient data is available regarding the exact number of users, but adoption is significant in targeted regions.
The type of	Smallholder rice farmers in Cambodia and Vietnam.	Smallholder farmers and Agripreneurs.	Primarily smallholder farmers seeking to enhance productivity

	Previous Successful Activities	Current Activities	Key Performance Quantities
users			and sustainability.
The unreliance of users	Farmers in Northwest Cambodia transitioned to broadcast direct seeding due to labor shortages.	Continued farmer independence from traditional methods, but need for mDSR specific knowledge remains	Sufficient evidence is not available

Readiness Metrics

Table 9a. Effective Demand Dimensions on Mechanized direct seeded rice (mDSR)

Factor	Status	Quantities	Evidence Source
Investment	Yes	● Vietnam's One-Million-Ha program mandates mDSR and fertilizer placement. ● IRRI has been actively involved in the research and development of mDSR in Cambodia and Vietnam. ● IRRI has conducted extensive research on suitable rice varieties, effective weed and pest management strategies, and the development of appropriate machinery for mDSR. ● A recent study by IRRI showed that Cambodian farmers could potentially	(CGIAR, 2025; The New Indian Express, 2025; CGIAR, 2025)

Factor	Status	Quantities	Evidence Source
		achieve higher yields (up to 0.9 tons/ha) and 40% higher profits by adopting mDSR.	
Influence	Yes	● IRRI collaborates with government agencies, research institutions, and private sector partners in Cambodia and Vietnam to promote mDSR and provide training to farmers. ● IRRI has published numerous research papers, reports, and training materials on mDSR. ● IRRI has conducted extensive field trials and demonstrations of mDSR in Cambodia and Vietnam. ● MARD officially endorsed mDSR and issued national guidelines for its implementation in the Mekong River Delta.	(CGIAR, 2025; CGIAR, 2025; IRRI, 2025; CGIAR, 2025)
Fit	Yes	● mDSR reduces labor needs, which is valuable in Cambodia and Vietnam, where out-migration from rural areas	(MDPI, 2025; CGIAR, 2025; IPM Innovation Lab, 2025; sustainablerice.org, 2025)

Factor	Status	Quantities	Evidence Source
		has created agricultural labor shortages. ● In the Mekong River Delta, farmer Vo Van Than adopted mDSR and experienced a 50% reduction in seed usage, a 7% increase in grain yield, and a 17% increase in profits. ● In Battambang, farmer In Soun successfully adopted the Eli Rice Seeder, leading to reduced seed, fertilizer, and pesticide use, as well as labor time. ● Sophea Say, a jasmine rice farmer in Battambang province, has successfully integrated sustainable practices into his rice production, expanding his farm.	

Table 9b. Technical Excellence Dimensions on Mechanized direct seeded rice (mDSR)

The factor	Status	Quantities informing the answer	Citation
Works better	Yes	● Yield increase of up to 0.9 tons/ha in Cambodia. ● 7% increase in grain yield in Vietnam (Mekong River	CGIAR. (2025). *Creating a path for scaling mechanized direct-seeded rice in Cambodia*. CGIAR, https://www.cgiar.org/news-

The factor	Status	Quantities informing the answer	Citation
		Delta). ● 5% increase in yields in Vietnam by EiA.	events/news/creating-a-path-for-scaling-mechanized-direct-seeded-rice-in-cambodia/ CGIAR. (2025). *Mechanized Direct Seeding Transforms Rice Production, Boosting Yield, Profit, and Reducing Carbon Footprint in Vietnam's Mekong River Delta*. CGIAR, https://www.cgiar.org/news-events/news/mechanized-direct-seeding-transforms-rice-production-boosting-yield-profit-and-reducing-carbon-footprint-in-vietnams-mekong-river-delta-5/
Cheaper	Yes	● 40% reduction in labor costs. ● 50% reduction in seed usage in Vietnam. ● 20% reduction in fertilizer usage in Vietnam. ● US$200 increase in profit per hectare in Vietnam. ● 40% higher profits by adopting mDSR in Cambodia.	The New Indian Express. (2024). *IRRI bats for mechanised direct seeded rice practice*. The New Indian Express, https://www.newindianexpress.com/states/odisha/2024/Oct/17/irri-bats-for-mechanised-direct-seeded-rice-practice CGIAR. (2025). *Mechanized Direct Seeding Transforms Rice Production, Boosting Yield, Profit, and Reducing Carbon Footprint in Vietnam's Mekong River Delta*. CGIAR, https://www.cgiar.org/news-events/news/mechaniz

The factor	Status	Quantities informing the answer	Citation
			ed-direct-seeding-transforms-rice-production-boosting-yield-profit-and-reducing-carbon-footprint-in-vietnams-mekong-river-delta-5/ CGIAR. (2025). *Creating a path for scaling mechanized direct-seeded rice in Cambodia*. CGIAR, https://www.cgiar.org/news-events/news/creating-a-path-for-scaling-mechanized-direct-seeded-rice-in-cambodia/
Simpler	Yes	• Eliminates the need for transplanting seedlings. • Faster crop establishment. • Significant reduction in labor requirements.	DIRECT SEEDED RICE CONSORTIUM. (2025). *What is DSR?* DIRECT SEEDED RICE CONSORTIUM, https://dsrc.irri.org/our-work/what-is-dsr The New Indian Express. (2024). *IRRI bats for mechanised direct seeded rice practice*. The New Indian Express, https://www.newindianexpress.com/states/odisha/2024/Oct/17/irri-bats-for-mechanised-direct-seeded-rice-practice

Table 9c. Use Dimensions on Mechanized direct seeded rice (mDSR)

Factor	Status	Quantities Informing Answer	Citation
More Users	Yes	In Northwest Cambodia, almost all rice farmers have transitioned from manual transplanting to broadcast direct	IRRI. (2025). *Creating a path for scaling mechanized direct-seeded rice in Cambodia*. CGIAR. Retrieved from

Factor	Status	Quantities Informing Answer	Citation
		seeding, although often not yet fully mechanized. In Vietnam, the government has supported mDSR through programs like the One-Million-Ha program.	https://www.cgiar.org/news-events/news/creating-a-path-for-scaling-mechanized-direct-seeded-rice-in-cambodia/; CGIAR (2025). *Mechanized Direct Seeding Transforms Rice Production, Boosting Yield, Profit, and Reducing Carbon Footprint in Vietnam's Mekong River Delta*. Retrieved from https://www.cgiar.org/news-events/news/mechanized-direct-seeding-transforms-rice-production-boosting-yield-profit-and-reducing-carbon-footprint-in-vietnams-mekong-river-delta-5/
Diverse users	Yes	mDSR is being adopted by smallholder farmers, as shown in the case studies from Cambodia, like In Soun and Sophea Say and Vietnam, like Vo Van Than, and this has been promoted by IRRI working with government agencies, research institutions, and private sector partners.	CGIAR (2025). *Mechanized Direct Seeding Transforms Rice Production, Boosting Yield, Profit, and Reducing Carbon Footprint in Vietnam's Mekong River Delta*. Retrieved from https://www.cgiar.org/news-events/news/mechanized-direct-seeding-transforms-rice-production-boosting-yield-profit-and-reducing-carbon-footprint-in-vietnams-mekong-river-delta-5/; IPM Innovation Lab. (2025). *Cambodian Farmer Implements

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			and Modifies Machinery, Improves Quality of Rice*. Retrieved from https://ipmil.cired.vt.edu/wp-content/uploads/2019/12/Eli-Rice-Seeder-Success-Story-1.pdf; IRRI (2025). *Perspectives from the Fields: From Smallholder Rice Farmer to Agripreneurial Success*. Retrieved from https://sustainablerice.org/from-smallholder-rice-farmer-to-agripreneurial-success/; The New Indian Express (2025). *IRRI bats for mechanised direct seeded rice practice*. Retrieved from https://www.newindianexpress.com/states/odisha/2024/Oct/17/irri-bats-for-mechanised-direct-seeded-rice-practice
Unreliant users	Yes	While farmers are adopting mDSR, the text explicitly states that the shift towards direct seeding in Cambodia has led to challenges such as high seed rates, limited access to mechanization, and increased weed and pest pressure, indicating a dependency on external support. The	MDPI. (2025). *Integrated Management of Weeds in Direct-Seeded Rice in Cambodia*. Retrieved from https://www.mdpi.com/2073-4395/10/10/1557; CGIAR. (2025). *Creating a path for scaling mechanized direct-seeded rice in Cambodia*. Retrieved from https://www.cgiar.org/n

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		text highlights the need for technical knowledge and skills to implement mDSR effectively suggesting a need for continuous support. The technology also requires investment in machinery and dealing with issues like weed and pest management, which requires external knowledge and in some cases products.	ews-events/news/creating-a-path-for-scaling-mechanized-direct-seeded-rice-in-cambodia/; PWOnlyIAS. (2025). *Direct Seeded Rice (DSR): Need, Benefits, And Challenges*. Retrieved from https://pwonlyias.com/current-affairs/direct-seeded-rice-dsr/; ResearchGate. (2025). *(PDF) Rice direct seeding: Experiences, challenges and opportunities*. Retrieved from https://www.researchgate.net/publication/229396674_Rice_direct_seeding_Experiences_challenges_and_opportunities;

Additional References

CGIAR. (2025). Creating a path for scaling mechanized direct-seeded rice in Cambodia. Retrieved from https://www.cgiar.org/news-events/news/creating-a-path-for-scaling-mechanized-direct-seeded-rice-in-cambodia/

CGIAR. (2025). IRRI and the General Directorate of Agriculture collaborate to promote precision direct seeding for rice in Cambodia. Retrieved from https://www.cgiar.org/news-events/news/irri-and-the-general-directorate-of-agriculture-collaborate-to-promote-mechanized-direct-seeded-rice-in-cambodia/

CGIAR. (2025). Mechanized Direct Seeding Transforms Rice Production, Boosting Yield, Profit, and Reducing Carbon Footprint in Vietnam's Mekong River Delta. Retrieved from https://www.cgiar.org/news-events/news/mechanized-direct-seeding-transforms-rice-production-boosting-yield-profit-and-reducing-carbon-footprint-in-vietnams-mekong-river-delta-5/

IPM Innovation Lab. (2025). Cambodian Farmer Implements and Modifies Machinery, Improves Quality of Rice. Retrieved from https://ipmil.cired.vt.edu/wp-content/uploads/2019/12/Eli-Rice-Seeder-Success-Story-1.pdf

IRRI. (2025). Vietnam's pilot low-emission rice farming shows promise: Increased yields, profits, and sustainability. Retrieved from https://www.irri.org/news-and-events/news/vietnams-pilot-low-emission-rice-farming-shows-promise-increased-yields-profits

MDPI. (2025). Integrated Management of Weeds in Direct-Seeded Rice in Cambodia. Retrieved

from https://www.mdpi.com/2073-4395/10/10/1557
sustainablerice.org. (2025). Perspectives from the Fields: From Smallholder Rice Farmer to Agripreneurial Success. Retrieved from https://sustainablerice.org/from-smallholder-rice-farmer-to-agripreneurial-success/
The New Indian Express. (2025). IRRI bats for mechanised direct seeded rice practice. Retrieved from https://www.newindianexpress.com/states/odisha/2024/Oct/17/irri-bats-for-mechanised-direct-seeded-rice-practice